

# ANNALS of SURGERY

A Monthly Review of Surgical Science and Practice

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# ANNALS *of* SURGERY

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## THE INFLUENCE OF WAR SURGERY UPON CIVIL PRACTICE

PRESIDENT'S ADDRESS BEFORE THE AMERICAN SURGICAL ASSOCIATION, JUNE 16, 1919

BY LEWIS STEPHEN PILCHER, M.D.  
OF BROOKLYN, N. Y.

WHEN at the opening of the Congress of the International Surgical Society in New York in April, 1914, President Depage announced as the theme of his inaugural address "War Surgery," it came as a distinct surprise to the great mass of those who were assembled to listen to him, for nothing was farther from the thought of the scientific world at that moment than War. Indeed, the very existence of the society before whom the address was being made was an evidence of the universal expectation of a continuance of that peace which for so many years had prevailed among the controlling nations of Europe. In the assembly to which his words were addressed were eminent representatives of England and France, of Belgium and Germany, of Russia and Italy, of Denmark, Norway, Sweden and Finland, of Austria, Poland and Hungary, of Holland and Portugal, and Roumania, all guests of the surgeons of North America. Was not such an assembly a guarantee of the continuance of that peace of the triumphs of which those men were such eminent representatives? And yet, before the pages of that address appeared in print, the fateful third of August had arrived and the world was plunged into a strife which arrayed these men as enemies, each to the other; was to array in battle sixty millions of men and was to cause the direct loss from the world's workers by death on the battlefield, or later from the wounds there sustained of more than ten millions of men.

Five years have passed, years the most tragic and historic of all the centuries. All of those men who were our guests five years ago have been compelled to devote their entire thought and labor during these years to the surgery of war. Some of them have suffered the supreme sacrifice which war exacts from its devotees. Of the active members of the American Surgical Association itself a large proportion have worn the uniform of their country's service, and of the remainder there is not one who has not regretted that, by reason of years or by reason of the importance of civil duties which could not be transferred to other hands, it has been impossible for him to follow the example of his younger colleagues.

To-day we are in expectation of approaching peace and it is possible for us once more to concentrate our thoughts upon the problems and

duties of ordinary life. We welcome again the appearance among us of our colleagues who have been in service abroad, as well as those whose duties have kept them in the encampments at home. The memories of the past and the pleasures of the present in this reunion unite to give to this meeting of our association a special spirit in which interest and pride and affection, memory and anticipation, unite to form a bond that brings us more closely together than ever before.

It is with the highest satisfaction, also, that we welcome the presence of representative surgeons from such countries as Belgium, France and Great Britain, to help whom in the tremendous burdens which the recent strife thrust upon them, has been the glad opportunity of so many of our number, and whose unfailing courtesy and grateful appreciation has been demonstrated to their American confrères in so many ways and upon so many occasions. We feel that we are honored by their journey across the Atlantic to be present at this meeting and we extend to each of them our cordial greeting and fullest homage, and through them we send to the countries which they represent our most grateful appreciation of the years of struggle and sacrifice which they have made in their labors to protect the world from an assault aimed at the foundation principles of civilization, a strife to share in which it was ever our duty and finally our privilege.

It is proper that we should pause a moment to do honor to the memory of those colleagues of our own blood who in this recent contest sacrificed their lives in obeying their country's call. From first to last nearly 35,000 American physicians donned the khaki and the blue of the Army and Navy as a patriotic duty. To by no means all of this number<sup>1</sup> was it given to go overseas, and of those who did cross the Atlantic a very considerable portion were prevented by their duties from reaching the front before the sudden and unexpected collapse of the enemy power removed at once the need for that service. All alike, however, were animated by the same spirit, and to all are due the credit and honor which belongs to the highest professional zeal and deepest patriotic devotion.

It is impossible to speak in too high terms of the character of the personnel of which the Medical Corps of the American Expeditionary Force was composed. They were men, not only inspired with patriotic devotion and filled with the hopefulness and progressiveness of youth and early manhood, and possessed of ability to endure hardship and labor, but in large proportion they were men of thorough and long training, many of them of large hospital experience, many specialists of distinction, keen in their professional spirit, enthusiasts in their work, ready and eager to cope with the surgical problems, however colossal, which demanded attention and solution. Of these, our companions, our pupils, in some cases our sons,

<sup>1</sup> The total number of officers in the Medical Department sent overseas is as follows: Medical Corps, 14,358; Dental Corps, 1924; Veterinary Corps, 887; Sanitary Corps, 1333. Total 18,494.

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who were of that number who were privileged to share the dangers of the enemy's offensives, 46 were killed in action; 22 died later of wounds received in action; 212 received wounds from which they survived; 38 were taken prisoners, 7 are registered as missing in action, and 4 were lost at sea. This is a record which would do honor to any body of men and is especially splendid for men deemed to be noncombatants; who were animated not by the special enthusiasm of combat, nor by the expectation of military fame or reward, but by that professional spirit peculiar to medical men which has ever caused them as a class to ignore danger and fatigue, and inconvenience of any kind in the performance of duty. The duty of the surgeon is ever to save life, to relieve the suffering, and when, in the performance of such duty, he loses his own life, does he not illustrate in the highest degree the spirit of the Great Teacher, "Greater love hath no man than this, that a man lay down his life for his friends"?

For the first time in supposedly civilized warfare, hospitals were selected as the special target of attack by an enemy's gun. The Red Cross was no longer sacred and the operation pavilion, or a nurses' home, was the object of an aerial bomb, as much as an ammunition train, or a depot of military supplies.

With reason, therefore, do we claim that the medical officer of the front and those assistants of humbler rank who shared his dangers and his labors are among the heroic figures of the war to whom due honor should ever be paid. It has well been said that none who have not experienced the stress, the anxiety and the limitations of surgical work during severe fighting can appreciate the problems and the difficulties of the work which had to be done under such surroundings; to which should be added as well, the dangers which they shared equally with those who were recognized as combatants.

To the memory of those of their number who under such circumstances lost their lives, their colleagues cannot pay too high honor. Those who sealed their devotion to duty, their patriotic fervor and their professional enthusiasm with their blood, who sleep now beneath the sod of a foreign soil, these are *our* heroes. They belong to a legion of honor more illustrious than that of any modern government; they wear a decoration of special merit awarded to them by their fellows of a universal brotherhood who best and most fully understood their merit. The cross that marks their graves indicates a distinguished service of which no other badge could be more significant. We honor ourselves as we hasten to place about their names ever renewed chaplets of laurel!

The war is over and we may now turn our thought as surgeons to garner its lessons, estimate its results, and place to future practical account its teachings. Animated by this idea, I have chosen as a theme suitable for the Presidential Address in this Victory Year, "The Influence of War Surgery on Future Civil Practice."

I am not unmindful of the fact that we are yet too close to recent

events to fully appreciate them in their proper relations, or to know what the ultimate influences that they may exert may be. Still there are even now certain things that are plainly discernible, and it is inevitable and advantageous that we should begin at once to take account of the new conditions and possibilities that have been demonstrated in the peculiar and vast experience of these years of warfare, and to speculate, also, upon the future changes which present conditions indicate. From many angles may be viewed the influence of the experiences gained in such conditions as those supplied by a war of such magnitude as the one through which the world has just passed, even when attention is confined to the single field of surgery, but it is only upon some of the larger, broader lines of the subject that I shall dwell at this time.

In this connection, the effects produced in the professional life and character of this country by the four years of the Civil War of 1861-1865, naturally at once present themselves to the mind of one who had a part in the experiences of that time and has been able to see and feel the effects which that war produced upon American surgery. This association is fortunate that among its Senior Fellows still remain some men who personally shared in the labors of that great war. Keen and Vander Veer, Nancrede and Weir still survive to benefit us with their counsel and to recall to our memory the trials and accomplishments of those days. May we not look to them now as to "Elder Statesmen" to strengthen, to judge, or possibly to correct, my own estimate of the effects upon civil practice of the surgery required and developed in the conditions of war?

The effects of war upon surgery and surgeons and upon the attitude of the public mind to surgery and surgeons is a fairly certain reaction. The times and men change, but the general effects are the same. Before 1861 the field of surgery in this country was a very narrow one.

The traumatic surgery which resulted from the battlefields of the war for the Union awakened the slumbering surgical spirit of the American medical profession, and when peace was declared in 1865 there returned to their homes, North and South, more than 25,000 medical men who were familiar with the most exacting of surgical emergencies to meet which they had been trained in conditions that called forth quickness, fortitude and self-reliance in an eminent degree. Their confidence in themselves had been awakened, their energy and experience had been broadened and their interest in surgical problems had been increased. But not alone was this surgical baptism enjoyed by commissioned officers. There was a great host of enlisted men who by reason of their hospital experiences, as patients, as nurses, as ward masters, as hospital stewards, had been made familiar with surgical work and had had their interest aroused in its problems, so that during some years immediately succeeding the close of that war, the medical schools of the country were crowded with men whose interest in medicine and especially their enthusiasm for surgery,

had been awakened by the experiences of that war. Hardly had these men returned to their homes, military surgeons and the graduates of army hospital wards, when the Listerian teaching was announced to the world. The relations of microorganisms to infection, and of infection to surgical catastrophes, were demonstrated, the whole field of surgery was immensely enlarged and there was presented to their eager minds a fallow field inviting their labors, the results of which were no longer uncertain and capricious.

One of the by-products of this awakening of the surgical spirit in the American profession was a constantly increasing appreciation among its leaders of the desirability and importance that the surgery of America should have a representative body. This fully culminated, finally, in the conference at Atlanta in 1879 at which the American Surgical Association was born. What a peace conference that was, when from New Orleans, Mobile, and Charleston, Boston, New York, Philadelphia, and Cincinnati, Chicago, San Francisco, St. Louis, Louisville, Nashville, and Richmond, assembled surgical leaders who a few short years before were arrayed against each other in fratricidal strife, now to unite in the formation of an association which was to typify a united America! It is not too much, indeed, to say that the very existence of the association which has called us together to-day, is one of the effects of "War Surgery Upon Civil Practice."

It is along similar lines, therefore, that I am inclined to think will be found the most important effects upon civil practice of the surgery of the recent World War. Surgeons of this war, after the experiences which they have had, both in the more trying conditions on the fields of combat and in the highly important demands to which they have been subjected in the base hospitals both abroad and in the cantonments of concentration at home, cannot escape the higher endowment which attends the enlargement in the scope of their surgical vision; which inevitably has heightened and broadened their professional aspirations, and which has resulted in a higher grade of attainment both in the science and art of their chosen profession, and which has greatly increased their usefulness as individuals in bringing relief to their fellow men. Perhaps the chiefest element in this mental change which has steadily grown out of the conditions of their daily work is an appreciation of the value of co-operation with their fellows to the end of diagnosis and *pari passu* with this an increase of mutual respect and a lessening of individual rivalries and an increasing devotion to the highest attainments of science. The most important effect of the recent war was upon the surgeons rather than upon surgery. Never before in the history of warfare have the merits and value of the medical staff for consideration as parts of the military machine been so fully acknowledged as in the war now closed. This has had its most marked evidence in the increased rank given to its

surgeons, for in an army there is one unfailing criterion as to the importance of a man and that is *rank*.

I have recently been rereading Fielding Garrison's charming and sympathetic biography of our late colleague, John Shaw Billings. Billings was commissioned an assistant surgeon in the United States Army in April, 1862. He was soon in charge of a great base hospital in Georgetown. He later was assigned to field duty with the Army of the Potomac, and had large responsibilities in the care of the wounded from the battles of Chancellorsville and of Gettysburg. As an inspecting medical officer, he was charged with important duties during the campaign of the spring of 1864, and finally, was assigned to duty in the Surgeon General's Office at Washington in December, 1864, where his erudition, his intellectual poise, his judgment of men, his unremitting industry and his great administrative ability enabled him to be of such great service to his country and to his profession for the succeeding fifty years. And yet, Billings, with his ability and his record saw no promotion in military rank during all the years of war. As an assistant surgeon, with the rank of first lieutenant, he entered the army in 1862, and he was still a first lieutenant when the victorious hosts of Grant and Sherman made their triumphal march down Pennsylvania Avenue in 1865!

I cite this case to contrast it with the different treatment accorded to the medical corps in this most recent of wars, in which there appeared a willingness to grant to medical men degrees of rank suitable to the responsible and important duties belonging to them, an appropriate acknowledgment of the inseparable qualities of hygiene and surgery as handmaids to sound strategy and combatant force to ensure ultimate victory. I take it, my colleagues, that this is a consideration that concerns us so much, both as citizens and surgeons, that we might well express our appreciation of the wise and admirable methods whereby this most desirable and important change has been accomplished.

I mention it now, however, because of its place in the chain of conditions that have an important influence upon the character of the surgeons who have so recently shared in the military spirit of their country's armies. It has to do with that intangible, undefinable, altogether admirable thing which we call "*morale*" which is the surest precursor of success and the most important element in the attainment of ultimate victory. Nothing contributes to it more than a sense that those for whom we labor, confide in us, depend upon us, honor us. In the military life this has its highest expression in what is called *rank*. The American Congress, when it established in the medical corps of the recent army the higher grades of rank with which it is now honored, at once not only gave to that branch of the service the recognition which its importance deserved, but with it increased in a notable manner the morale of the whole service, as it granted to so large and important an element of it such assurance that it confided in it, depended upon it, honored it. Every member

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of the medical staff of this army has felt the influence of this new attitude of their government to them, and each one in returning to his home and resuming the duties of civil life, will continue to feel its broadening and stimulating influence to a higher degree of professional work.

The compactness of the territory within the limits of which the chief contests of this war have taken place; the comparative stability of the areas of combat and the great prolongation of the struggle made it possible for the surgeons of the forces from all parts of the extended front, by mutual conferences affording personal exchange of experiences, to early establish a progressively improving standardization of methods of practice; a standardization which contributed greatly to the remarkable degree of efficiency ultimately attained. The various allied governments apparently vied with each other in effecting organizations that could provide to the fullest possible degree for the needs and exigencies of the demands of their armies for surgical relief, including hospitals, matériel, literature, and methods of supply and of evacuation, all of which contributed greatly to the encouragement, the inspiration and the positive assistance of surgeon and patient. The ubiquity of the organization and the instant readiness with which the agents of the Red Cross responded to emergent calls for helpers and for supplies of every kind wonderfully supplemented the slow movements through official channels. Each element, official and volunteer, contributed a share in bringing about the results of the surgery of this war, as each has been an element in making possible the final measure of successful relief secured.

To one who has occupied a point of view so peculiarly detached and so broadly and deeply sympathetic as that in which your speaker has been placed, who from the circumstances of his own early years of military service ashore and afloat, in time of war and in time of peace, has been able to realize the many-sided character of the relations of surgical organization and of surgical work in the military ensemble of the great war, the one great thing that stands out as the preëminent feature in the surgery of this latest war is the fullness with which the military importance of the provisions for surgical relief and sanitary prevention has been recognized by the governments involved. We may be sure that there will be no step backward in the future. The magnificent results which the surgery of the war has shown have forever closed the mouths of those who would belittle the position of the "Doctor in War." The thought which is in my mind in this connection, however, has to do more especially with the effect upon the medical men themselves which this recognition has produced.

When the newly appointed medical officer first entered the training camp to which he was sent, he began at once to appreciate that he was a part of a great military machine whose spirit he must imbibe, in whose labors he must bear an important part and in whose glories he was to share. The transformation in his mentality, in his sense of relation to his

fellows, in his grasp of the real values of life's problems which rapidly took place in him, can never be reversed. When he is finally mustered out of the service and resumes his life as a civilian, he does not and cannot return to the same status which he occupied when he first assumed the military dress. There has inevitably been awakened in him a divine dissatisfaction with the old life and a longing after a higher standard of professional attainment and life. His professional spirit has been heightened, strengthened and chastened. This direct fruition of war-time conditions has been experienced by some in greater degree than by others, but no one has escaped its influence in some degree. This, then, is the highest, most important, most beneficent of contributions of the surgery of this war to the civil life of the nation, namely, a quickened, ennobled, more efficient body of surgeons; a body of men who in the hard school of war have received an endowment of enthusiasm, an illumination of spirit, and an ability to persevere and conquer success under difficulties which they will carry with them during the remaining years of their life, and which qualities in some measure they will transmit to, or create in their successors.

Without in any way minifying the extraordinary results which have been attained in the surgical efforts of this World's War, is it not true that in general these results are but demonstrations and applications, though often upon a colossal scale, of principles and truths which the work of the previous fifty years had been accumulating for its use, rather than the development of any new and important principle which, with the disappearance of the special conditions of combat destructiveness, will remain to us as a permanent addition to surgical practice to modify the surgery of civil life hereafter?

The traumatic surgery of this war has constituted a tremendous vivisection experimental laboratory in which not mice, nor rabbits, nor guinea pigs, nor dogs have been the subjects of experiments, but human beings, the choicest young men of the civilized world. To the solution of the problems of the surgery of the last and greatest war was concentrated the experience, the researches, the labors, the maturest surgical thought of all the years to which the traumatic surgery of 1861-1865 was a prelude, years during which surgery became so largely a science, definite, positive, certain, as well as an art, wonderful and merciful in its results.

It is true that the exigencies of war have produced many modifications and adaptations of surgical technic. New antiseptic agents and combinations have been introduced. The scale upon which work has had to be conducted has been immensely enlarged beyond that ever called for in civil practice. The wounds which had to be cared for, as a rule, presented more extensive lacerations and were the subject of more intensely virulent infections than had ever before been met with in warfare. The urgency of the work has been at times overwhelming and the provisions for desirable technic were often unavoidably inadequate. Notwithstanding

ing all these facts, we now see that through the perfection of the organization of surgical relief which was accomplished the results of the surgical methods adopted for the treatment of this vast traumatic surgery were better than those witnessed ever before in warfare. It is true that in the urgent stress of combat conditions, there was often haste and crudity in the methods employed. The shifting battle conditions produced at times an enormous disproportion between the demand for work and the possibility to respond to it. There were days of unavoidable irregularity and urgency of demand that discounted all anticipation, but never before was so perfect an organization evolved for bringing early and adequate surgical relief to the wounded.

The stations for first aid, the casualty clearing stations and the base hospitals, formed a series of provisions for relief that provided in succession for supplying the needs of every emergency in the progress of the wounded man from the reception of his injury upon the open field or in the trench to his ultimate return to duty as a cured man in a degree that compels our astonished admiration at its fullness and its success. It is true that in the earlier days of inexperience and confusion there was registered much of disappointment and failure in the provisions for relief that were made. We do not close our eyes to the enormous amount of suppuration and gangrene which developed in the wounds of that time. The manner in which, however, these conditions were mastered and the reasons for them appreciated and overcome, and the ultimate success of the surgery attained, forms one of the most remarkable and triumphant chapters in the history of surgery.

The accumulated statistics of the war, notwithstanding all its inevitable disasters and failures, show that more than 93 per cent. of all wounded men who lived to come under surgical care recovered from their wounds and that from 70 to 80 per cent. of all casualties were able to return to duty within two months.

Any study of the specific details of the practical surgery which was elaborated and carried out to bring about such a result cannot be entered upon at this time. These details form chapters in the surgery of war which will ever be of the highest importance, not only as presenting surgical effort in its most exalted phases, but also as lessons of supreme value in directing the surgery of the future, not only in conditions of warfare, but in the civil practice of times of peace. The careful studies of the subject of shock, with its demonstration of the possibility of carrying on, even in conditions immediately behind the line of battle, such a procedure as blood transfusion, the widespread, almost universal use of prophylactic injections of the antitoxin to forestall tetanus, the practical establishment of minute details whereby sepsis was controlled and anti-sepsis made efficient, and above all, the demonstration and universal adoption of methods of early surgical resections of wounds whereby they were converted into clean wounds, the ultimate healing of which was no

longer an uncertain and prolonged process, but became a sure and rapid exhibition of primary healing; and those results which were obtained by the surgery of various regions, the surgery of the brain, and that of the peripheral nerves; the surgery of the face, the surgery of the chest, as the result of which the thorax, which always had been practically a closed area to surgical effort, was demonstrated to be as accessible and as promising a field as any other portion of the body; the abdomen and the extremities, with which latter are associated the problems of bone and joint infections; all these have already been the subject of intensive studies, in each department of which most important contributions have been made by Fellows of this Association who now sit before me. These in their order and place will occupy our interested attention for years to come.

It is most notable that steadily from the beginning to the close of the conflict in every line of effort, better and better results were being secured and more successful responses to the emergent needs of wounded men were being made. Who can say how great a contribution in the production of the magnificent morale of the allied troops which carried them on to final victory was the knowledge which these men had of the care which they would receive should wounds and disease overtake them?

With full appreciation of the record which surgery has made in this vast school during these four years of intense strife, is it not true that they present, not so much the wonderful results of new discovery, or the brilliant work of some group of extraordinary surgical geniuses, but rather the constant, full value of sound surgery, the possibility of applying even in the conditions of combat fundamental surgical principles, worked out by a body of men endowed primarily with the elementary surgical instinct, but now illuminated and heightened by the peculiar influences of patriotic fervor and high ideals, and made practically efficient by the trained coöperative work which in the highest degree the military conditions afforded?

In conclusion, may I not say that the highest service which war surgery shall have rendered civil practice will be to have perpetuated this same spirit among these men as they return to their various fields of daily life?

## GENERAL CONSIDERATIONS AS TO THE TREATMENT OF WAR WOUNDS \*

By ANTOINE DEPAGE, M.D.

OF BRUSSELS, BELGIUM

COLONEL AND MEDECIN PRINCIPAL DE PREMIERE CLASSE, BELGIAN ARMY, DIRECTEUR DE LA CROIX ROUGE DE  
BELGIQUE

AMONG the important scientific contributions which have been produced in the course of this war, those which pertain to surgery have been, perhaps, the most characteristic and the most productive of important results. They have impressed upon the treatment of wounds a new evolution which will make an epoch in surgery.

Observation has shown us in the first place, contrary to what had seemed to be established by previous wars, that in the great majority of cases wounds are infected, or, at least, contaminated. In consequence of this first dictum débridement became to all surgeons a formal indication of the first rank. In general, all wounds inflicted by war fragments or from grenades, as well as the wounds by shrapnel or of bullets, which produced serious lacerations in the interior of the tissues or were accompanied by an abundant bloody effusion, were freely opened up immediately upon the arrival of the wounded at a hospital organization sufficiently equipped. At the same time the contused and lacerated tissues which constituted a medium favorable for microbic growth were cut away with the greatest care so that there was effected a veritable "épluchage" of the wound before proceeding to its dressing.

As a complement to this surgical intervention, surgeons had recourse for awhile in grave cases to cauterization by the thermocautery, or by superheated air or by the application of a chemical. These various agents, however, were given up because of their unduly violent action.

Since January, 1915, we have followed at l'Ambulance de l'Océan débridement and épluchage, with primary suture, when the cases appeared to us favorable, or we have resorted to secondary suture, as soon as after their dressing the surfaces of the wound appeared to be clinically aseptic, although we did not possess at that time any formal index as to the evolution of the microbial flora in a wound, so that it was not possible for us then to build up a systematic method of procedure. The merit of having systematized scientifically the secondary suture of wounds belongs to Alexis Carrel, who at the beginning of the war put himself at the disposition of the *Service de Santé* of the French Army and was put in control at Compiègne of an experimental clinic of 80 beds. With the help of the chemist Dakin, Carrel sought for an agent capable of destroying the microorganisms in the depths of wounds, more efficient than any of the agents which had up to that time been recommended.

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\* Read before the American Surgical Association, June 16, 1919.

After a very minute study made by Dakin as to the relative value of a large number of antiseptic agents, Carrel chose the hypochlorite of soda which even in dilute solution has the great property of conserving the proteins and of preserving also its antiseptic power in the presence of blood serum and organic exudates. The great inconvenience of the sodium hypochlorite was its caustic action upon the tissues and particularly upon the skin. Dakin remedied this by preparing a solution of the hypochlorite of a determined strength perfectly steady and by neutralizing it with boric acid.

I need not detail here the preparation of the Dakin solution. I will dwell only upon two points.

1. The solution must be fresh, prepared from day to day.
2. Careful verification must be made as to its reaction and all preparations must be rejected which are not absolutely neutral.

But the method of Carrel does not consist alone in the choice of the solution of Dakin for the irrigation of wounds. The way in which this solution is employed constitutes an essential point of the method. The different steps of the method as finally used by us may be stated as follows:

1. Beginning with the admission of the patient in the hospital, the injured region is shaved and washed carefully with a neutral solution of oleate of soda.

2. Débridement and épluchage of the wound are practised immediately thereafter.

3. At the same time are installed the Carrel tubes which are introduced to the bottom of the wound in such fashion as to permit the irrigation of the entire wound surface.

4. Application to the entire surroundings of the wound of compresses smeared with vaseline in order to prevent irritation of the skin.

5. Dressing with compresses of absorbent material.

6. After the return of the patient to bed, the Carrel tubes are connected up with the receptacle containing the Dakin solution and irrigation is carried on every two hours, controlled by a simple pressure forceps of Mohr.

7. The dressings are renewed every day and in the course of each one of them, careful lavage of the wound is made with oleate of soda. One must not permit to remain upon the skin about the wound the slightest concretion, for they always hide colonies of microbes.

However, it was not possible for us to judge the method of Carrel at its true value and to derive from it all its benefits until we were able to follow the evolution of the wound by methods of bacteriological control.

This control was a most valuable element in the method of Carrel. It consists in the regular determination of the abundance of the micro-organisms in the wound exudates.

To carry it out there is made a simple smear according to the usual

laboratory methods, in which are counted the number of microbes contained in the microscopic field. This bacteriological control was established in a systematic way in our hospital from the beginning of June, 1916. Every two days it was repeated in the same wound. At one time it was being applied in more than 500 patients at a time. For the purpose of being able to follow at a glance the progress of infection in a wound, we have made tracings of the microbic strength. We have made use for this purpose of charts of a special model, resembling temperature charts.

In a general way the microbic curve followed a characteristic line. On the entry of the patient in the hospital or when the wound had just been opened up, the chart indicates in the majority of cases no microbes. At this time the wound is only contaminated, and the infection has not spread over its whole surface. On the second day the chart shows a sharp ascent in the microbic growth and holds itself at high level for some days. In severe infections there may be counted 100, 200, even 1000 microorganisms in a visual field. The line undergoes afterwards more or less oscillations, the progress being more or less downward until the zero point is arrived at after the lapse of a variable time according to the character of the lesion or the nature of the infection.

Sometimes the wound is maintained sterile from the first day, the microbic track following the horizontal line to zero.

The infected wounds were rendered sterile by the Carrel treatment in from six to eight days.

Other solutions recommended for the same purpose gave in general a sterilization more slow and less certain. Certain agents, as flavine, seemed to produce a rapid sterilization in a way more efficient than the Carrel, but generally the results were not stable in their sterilizing power, because they disturbed the granulation of the wound and favored secondary infection.

In the cases of infected fractures the line descended permanently to zero, only after fifteen days to one month. Osseous wounds were sterilized moreover with difficulty. It was the same also with articular wounds. Whenever a sequestrum was present, it was necessary to take it away before definitive sterilization of the wound could be obtained.

The wounds which were soiled and irregular were sterilized more slowly than simple wounds. The bacillus perfringens (gas bacillus) and in general all microbes producing gaseous gangrene did not alter the course of the curve. These microorganisms disappeared rapidly from the wound whenever it was freely opened up and freely pared. Staphylococcus persisted longer. In cases of staphylococcus infection the zero point was arrived at very slowly and very often the infection persisted notwithstanding the treatment.

In fact, bacteriological evolutions in a wound may be considered in three periods:

1. The period of acute infection of variable duration in course of which the microbes are very numerous and present a maximum degree of virulence.

2. The period of attenuated infection during which the curve follows a descending course and corresponds to an attenuation of the microbial virulence.

3. The period of sterilization which is indicated at a line horizontal with zero.

Our collaborator Govaerts has shown that these three periods of microbic infection correspond to three periods in the organic reaction of tissues.

1. During the period of acute infection there are then only polynuclear elements in the wound exudate.

2. In the later course of the microbic disease the polynuclear elements disappear and there are found in the preparation mononuclear elements which become more and more numerous. At the end of this period macrophagi begin to appear.

3. In the course of the period of sterilization there exists in the preparation in the macrophagi.

Evidently, gentlemen, we do not attribute to the microbic curve an absolute value, but in the majority of cases its practical value is the real one, for it permits us to follow the evolution of the infection in the wound and indicates the moment when suture may be practised with the greatest probability of success.

Experience has shown us, nevertheless, that it is necessary to take into account in deciding the moment of suture, not only the quantity of infectious agents present, but their quality and from this point of view was recognized:

1. That wounds slightly or moderately infected by ordinary microbes may be sutured without danger and with every chance of success.

2. That the presence of staphylococci does not contraindicate suture.

3. That the perfringens remain enclosed in the wounds only a very short time, but as long as these microbes do not disappear it was dangerous to resort to suture.

4. That a wound should not be sutured when there was even a slight streptococcic infection.

For the purpose of specifying more exactly the microbic flora of the wound and of determining better the moment most favorable for suture, we have thought it useful to supplement the counting of the microbes upon the smears subjected to bacteriological examination by cultures instituted regularly after the débridement and before the suture. We have to this end adopted a more complete microbic chart, proposed by Doctor Levaditi of the Pasteur Institute, who has devoted himself especially with us to the study of the infection of wounds.

## THE TREATMENT OF WAR WOUNDS

The conclusions as to suture up to the present moment have been as follows:

(a) For wounds feebly infected from the first day with ordinary microbes by proceeding to suture when at the second examination the smear yields only one microbe in a visual field.

(b) For wounds strongly infected by ordinary microbes, resort to suture from the moment when the curve came down to one microbe in four fields.

(c) For streptococcic infection never to suture but to submit the wound to adequate treatment, preferably that of Carrel, and to wait until the streptococci had disappeared, or had become attenuated sufficiently to permit primary union.

Streptococcic vaccination may render here the greatest service. The researches made in our hospital by Doctor Levaditi leave no doubt on this point.

Such, gentlemen, are the most important general rules which in our opinion should guide us to-day in the treatment of war wounds, and which have as their object the production of a sterilization of the wound sufficiently complete to make successful suture possible.

*Immediate primary suture* may be made immediately after débridement or it may be made from two to four days after débridement.

*Delayed primary suture, or early secondary suture.* In this latter case is done as is primary suture, without refreshing of the wound surfaces by simply approximating the surfaces. Finally, the suture may be made in the course of the granulation of the wound when sterilization has been sufficiently assured.

*Secondary suture.* This always necessitates the refreshing of the wound surfaces by which step it is distinguished from the preceding methods of suture.

The immediate suture is indicated in cases where the clinical aspect of the wound after débridement and épluchage gives a guarantee of sufficient sterilization. It may be resorted to especially:

1. In wounds of joints, and in general, in wounds of serous cavities.
2. In wounds of the cranium, of the face, of the hand and of the foot, where the abundance of vascularization, both blood and lymph, warrants a surgeon in making immediate suture as a rule.

3. In superficial wounds of the soft tissues in certain fractures without comminution. This suture has the advantage of offering anatomical repair of the tissues, but infections, when they take place, are always rapid and grave, involving diffuse phlegmonous and gaseous gangrene.

*Late primary suture or early secondary* is indicated particularly for wounds involving soft tissues only and for some open fractures. It is done after bacteriological control has been made as described above. Late primary suture rarely fails of success on account of grave accidents.

*Late secondary suture* is reserved for wounds which can not be sutured

during the first days, because of too extensive destruction of tissue, or because of the development of infection. It offers the great advantage of giving complete security, but it delays the healing and does not always give as perfect an anatomical restitution as the other forms of suture.

There remains now for examination the problem of the treatment of war wounds from more special points of view, and of considering the peculiarities which arise from the organ or the tissue wounded.

We shall examine in succession:

Wounds of the cranium.

Wounds of the face, of the hands and the foot.

Wounds of the soft tissues.

Amputation stump wounds. Fractures.

Joint wounds.

Wounds of the chest.

Abdominal wounds.

We shall limit our discussion to general indications.

*Wounds of the Cranium and of the Hairy Scalp.*—When we have to deal with a wound of the hairy scalp, limited to the soft parts, we cut away the margins of the contused surface and suture them immediately. When the cranium is wounded without an opening in the meninges, we practice regularly trephining in order to take away the fragments in the internal table which are practically always present and, as in the case of wounds involving only the hairy scalp, we finish with immediate suture.

When a wound of the brain has taken place two complications are feared: 1. Cerebral hernia. 2. Meningo-encephalitis, that is to say, infection of the meningo-encephalic spaces.

The hernia is the result of the œdematous and blood congestion of the cerebral substances during the first hours which follow the traumatism. It corresponds to the swelling of the external features in wounds of the face, but with this special feature that encephalic congestion drives to some degree the cerebral contents out from the cranial box. Once established, the cerebral hernia invites infection and favors its development by the spaces which are created beneath it and which it is impossible to keep aseptic. We find ourselves then always in the presence of a vicious circle, the continuity of which it is often difficult to break.

Therefore, in treating a wound infection the surgeon should always seek to hinder the production of the hernia. Dressings which produce compression are from this point of view indispensable above all on the first days.

The ideal treatment consists without doubt of disinfection at a single sitting of all cerebral lesion and in immediate closure of the wound, but the experience at our hospital has been that wounds of the brain are contaminated or infected by the projectile in the proportion of 55 to 60 per cent., and that it is not possible to render them sufficiently aseptic at

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a single seance by any means at our disposal. Therefore, the immediate closure of the cranial breach has been attended with danger in a number of cases.

In determining the course it is necessary to be guided by the microbic curve and to resort either to late primary suture or to early secondary, or to secondary suture more or less late, if a sterilization is more or less late in being accomplished.

*Wounds of the face* have this in particular, that they involve vascular regions not favorable to the development of gaseous gangrene and to infection in general, they may with all certainty be brought together by immediate suture in most cases. Moreover, the retractions which inevitably follow in a wound of the face left open for a certain time often prevent apposition of the skin when a secondary suture is made and produce deformities more or less marked. It is then a matter of importance to close wounds of the face as early as possible.

When the lesion is superficial and the soft tissues alone are involved, cutaneous flaps may be formed and the suture definitely accomplished at the same seance. Complicating fractures of the jaw do not constitute an obstacle to the immediate suture. The specialist may generally succeed in manipulating through the reconstituted buccal cavity the prothetic apparatus which is necessary to hold the fragments in coaptation. If the mass of the face is widely destroyed, the skin should be brought over it as far as possible so as to prevent retraction, and æsthetic repair of the face should be accomplished later by rhinoplasty, cheiloplasty, or other autoplasic processes.

*Wounds of the Hand and of the Foot.*—It is important here, likewise, to suture the wounds as early as possible in order to prevent retractions and to lessen the losses of functional power which may follow. But though immediate reunion may practically be possible in all superficial wounds where they are limited to the hand and to the foot, it is not always so when the destructions of tissue have been great. Infection in these cases is often difficult to overcome because of the multiplicity of the cellular spaces and the complexity of the joint cavities which often connect with each other. To secure their sterilization it is necessary to widely open the wound throughout its whole extent, and for this purpose resection and wide arthrotomies are often indispensable.

We have operated during the period from June, 1916, to November, 1917, on 523 wounds of head, face, foot and hand which have resulted as follows:

- (a) 491 Immediate sutures which have given:
  - 473 Complete successes, *viz.* ..... 96.3 per cent.
  - 8 Partial successes, *viz.* ..... 1.6 per cent.
  - 10 Failures, *viz.* ..... 2.1 per cent.
- (b) 18 Late primary sutures which have given:
  - 18 Complete successes, *viz.* ..... 100 per cent.

(c) 64 Secondary sutures which have given:	
58 Complete successes, viz. ....	90.6 per cent.
4 Partial successes, viz. ....	6.2 per cent.
2 Failures, viz. ....	3.2 per cent.

*Wounds of the Soft Tissues.*—Superficial wounds of the soft tissues lend themselves generally well to immediate suture, and according to the more or less large extent with which the processes of débridement and épluchage have been resorted to we may determine the indications of the wounds in a large measure. It would be dangerous, however, to go to too great an extent in this direction, for immediate suture does not permit any bacteriological control, and very often the perfringens bacillus and the streptococcus are there, only awaiting a favorable occasion for their development.

One should not lose sight of the fact that in delaying the suture in order to permit of a preliminary bacteriological examination one does not practically prevent the healing. If, in fact, the wound is sterile at the beginning, the microbic test will show it and one can practice the late primary suture on the second, third, or fourth day, with every certainty of success. If, on the contrary, infection persists after the débridement and the épluchage of the wound, it has been to the interest of the wounded man that the microbic curve has been established and that the suture should be done secondarily after sufficient sterilization.

However, it may be accepted as a general rule that primary suture of a wound should not be the rule:

- (a) When the lesion dates back more than eight hours.
- (b) When the patient has been already subjected to previous surgical examination.
- (c) When the lesions involve deeply the muscular masses and when the tissues are much soiled and lacerated.

As we have seen, secondary suture is done by bringing the margins together after refreshing and removal of the cicatricial film. The granulations are left in place; they do not hinder the union by first intention.

When the wound is irregular, in certain cases the irregularities may be overcome by dissecting the granulations without and within, so as to turn them over upon themselves. Moreover, the muscles may be dissected and sutured to their fellows. Care should always be taken to suture the aponeuroses in order to prevent later muscular hernias. If very strong tension of the skin is present, it is necessary to make more or less extensive slidings thereof. Sometimes one must proceed to a cutaneous débridement. Quite often we have had recourse to grafts after the Italian method, or to epidermic grafts, or often to the "greffe en culbute," which consists in cutting the cutaneous flap at a distance more or less great from the wound and bringing it to the wound by successive steps, turning it over upon itself.

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The number of wounds of the soft tissues which have been treated during the period from the month of June, 1916, to the month of November, 1917, has been 1447, the outcome of which has been as follows:

- (a) 380 Immediate sutures with:
  - 317 Complete successes, *viz.* ..... 83.9 per cent.
  - 24 Partial successes, *viz.* ..... 6.3 per cent.
  - 39 Failures, *viz.* ..... 29.8 per cent.
- (b) 222 Late primary sutures with:
  - 207 Complete successes, *viz.* ..... 93.2 per cent.
  - 8 Partial successes, *viz.* ..... 3.6 per cent.
  - 7 Failures, *viz.* ..... 3.2 per cent.
- (c) 845 Secondary sutures with:
  - 724 Complete Successes, *viz.* ..... 85.6 per cent.
  - 70 Partial successes, *viz.* ..... 8 per cent.
  - 51 Failures, *viz.* ..... 6.4 per cent.

*Amputation Stump Wounds.*—When a surgeon amputates a limb, he should never forget that the stump is to support later an artificial limb. This idea is so often lost sight of in the course of amputations that I feel that I should insist upon its importance. The surgeon uses all his skill in fashioning a fine flap which carries the suture line upon the side, but he takes no account of the length of the arm for leverage to which an apparatus may be fitted. The immediate operative result occupies his mind only, while he leaves to the orthopædist the care of the prothesis without troubling himself with the importance that he should furnish to the latter a stump easy to equip.

It is, nevertheless, proper to remark that formerly the bearing of prosthetic appliances was at the end of the stump, and that therefore a lateral scar had its reason for being, but most modern apparatuses take their point of bearing over the whole surface of the stump and leave the extremity free from any contact whatever. The result is that the apparatus now used are more appropriate for a terminal cicatrix than for a lateral cicatrix, and that they may often be put in place before cicatrization is entirely completed. Adherent scars when they are terminal do not otherwise constitute an obstacle to the prothesis, and in making the decision it is always the length of the arm of the lever which should take precedence over the qualities of the cicatrix.

From another standpoint we formulate three essential considerations which should cause us to reject primary suture in a great number of cases of amputations for war wounds.

(a) It is necessary to act quickly and to seek first, above all, to save the wounded man's life.

(b) Primary union is difficult to secure. The stump wound being generally infected, its immediate closure is sure to produce great complications.

(c) It is necessary to amputate as low as possible, often through a traumatized area, in order to leave the bone as long as possible.

*Guillotine amputations* are from this point of view the most favorable. They give, after repair of the stump, a lever arm longer than amputations after primary suture with a flap, the fact being that such suture rarely succeeds and if done it is necessary to intervene a second time.

We have made since June, 1916, to November, 1917, 31 secondary sutures after amputation which have given 26 complete successes, 4 partial successes, and 1 failure.

*Open Fractures of the Long Bones.*—The objective toward which we direct the surgical treatment of open fractures apart from the orthopædic treatment, is the transformation of an open fracture into a closed fracture. To this end:

(a) Musket-ball fractures with through and through wounds, with small orifice of entry and of exit, without swelling and without lesion of the great blood-vessels, are treated aseptically and are simply immobilized in an apparatus with extension. The patient is watched closely for the first week and if accidents of infection develop, the fracture is operated upon.

(b) Other fractures are operated upon at once. The wound is opened up by an incision sufficiently wide to permit of a deep exploration of the entire wound area surrounding the fracture; at the same time excision of the lacerated soft parts and extraction of foreign bodies is accomplished. Free bony fragments are taken away with care, pointed bone ends which threaten the vessels and the nerves are resected, but care should be taken to preserve as far as possible a bony bridge between the fragments in order to favor consolidation.

The wound is then sutured immediately either by late primary suture or by secondary suture according to the seat and extension of the lesion and the gravity of the infection.

Immediate suture is attended only in cases very exceptional which present a minimum of soft tissue, as the humerus and forearm. It is never practised in the course of an offensive and is contraindicated in wounds of the soft tissues when the wound dates back more than eight hours, or if a wound can not be kept under the same surgical oversight.

Primary delayed suture or early secondary suture is practised when the microbic curve present shows a sufficient sterilization from the beginning of the treatment.

Late secondary suture is the most frequently resorted to. It may be used as soon as the Carrel treatment has obtained the clinical sterilization of the lesion, that is to say, from fifteen days to a month, unless the infection has been due to streptococci. In the event of this last accident, suture may be delayed for several months.

The treatment which we have just sketched and which consists in transforming the open fracture into the closed fracture shortens much the time necessary for cure and guards the patient from the complications produced by prolonged immobilization.

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We resort to amputation in case of fracture only in extreme cases. Experience has shown us that one can by careful application of the method of Carrel preserve limbs which in former times would have been considered irremediably lost.

The number of fractures operated in our service from May, 1916, to November, 1917, has been 191, divided as follows:

(a) Fractures of the femur, 43, of which there were 4 primary sutures with 4 cures, *viz.*, 100 per cent.

Under delayed primary suture

39 Secondary sutures which gave:

30 Complete cures, <i>viz.</i> .....	76.9 per cent.
7 Partial successes, <i>viz.</i> .....	17.9 per cent.
2 Failures, <i>viz.</i> .....	5.2 per cent.

(b) Fractures of other bones: 148.

26 Primary sutures with:

20 Complete cures, <i>viz.</i> .....	76.9 per cent.
3 Partial successes, <i>viz.</i> .....	11.4 per cent.
3 Failures, <i>viz.</i> .....	11.34 per cent.

20 Delayed primary sutures with:

16 Complete successes, <i>viz.</i> .....	80 per cent.
4 Partial successes, <i>viz.</i> .....	20 per cent.

102 Secondary sutures with:

92 Complete successes, <i>viz.</i> .....	90 per cent.
3 Partial successes, <i>viz.</i> .....	3 per cent.
7 Failures, <i>viz.</i> .....	7 per cent.

*Joint Wounds.*—Under the head of joint wounds, we simply include those of the large joints, as of the knee, of the hip, of the elbow, and of the shoulders. In general, an articulation kept open becomes infected notwithstanding the most daily care. On the other hand, the immobilization to which the limb is subjected added, to the constant irritation of the joint surfaces by the secretions with which they are bathed determines the presence of adhesions and ankyloses.

During the first period extending from December 20, 1914, to September 10, 1915, we treated joint wounds by the system then in use everywhere, which consisted in the drainage of the cavity, the dressings being renewed several times a day at each of the dressings to irrigate with an antiseptic solution, such as oxygenated water, formalin water, carbolated water, etc. The limb was immobilized either by means of an interrupted apparatus (bridged) or by means of a gutter. The results were frankly bad. At this time the wounds of the knee-joint were considered as the gravest in character in war surgery.

During a second period, extending from December 10, 1915, to July 1, 1916, we applied the method of Carrel after débridement of the wound. The results were a distinct improvement over those of the first period,

but they were still not very brilliant. They demonstrated to us, especially for the knee, that the method of Carrel was not sufficient to make certain in a dependable manner the practical sterilization of a joint cavity.

Since the month of July, 1916, we have resorted to wide arthrotomies with immediate closure of the joint whenever possible.

From the month of May, 1916, to the month of November, 1917, we made:

(a) Sixty-six immediate sutures for wounds of the large joints without bony lesion. Of these there were 62 cures, *viz.*, 95.7 per cent.; 4 failures, *viz.*, 6.1 per cent.

(b) Seventy-nine immediate sutures for wounds of the large joints, with bony lesions. Of these there were 71 complete successes, *viz.*, 89.8 per cent.; 1 partial success, *viz.*, 1.2 per cent.; 7 failures, *viz.*, 7.0 per cent.

These results show indisputably the superiority of immediate suture after wide arthrotomy, closing of the joint cavity, over any other method of treatment. It is necessary, however, not to lose sight of the fact that conditions do not always favor a primary suture at the elbow and at the shoulder. In wounds of these regions, in fact, the soft tissues are often so torn that it is impossible in many cases to secure apposition in the wound borders. The Carrel treatment followed by secondary suture or by cicatrization by second intention is evidently indicated in such cases.

On the other hand, the results of resections are not the same for the elbow and the shoulder joints, as for the knee-joint. In the two first, resection results in articular mobility, while in resecting the knee the movements of the joint are in great measure destroyed. Therefore, for the shoulder and the elbow, one easily decides to do a resection, when one shuns it at all hazards in cases involved in the knee. Aside from cases in which there was a simple through and through wound with minute orifices which healed spontaneously, the treatment of choice of numerous war wounds involving a joint consists in a wide opening of the joint, a careful cleansing of the cavity, curettage of the osseous surfaces, if they are injured, and the immediate suture of the wound, with or without drainage. Immobilization is de rigueur from six to eight days.

The Carrel treatment is indicated in joint wounds with extensive lesions of the soft tissues which do not allow approximation of the skin, which is often the case at the elbow and at the shoulder. However, in these cases the attempt may be made to close the fracture primarily by means of a sliding of skin or by an autoplasty. Finally, a resection is justified in extensive lesions of the bony ends, but it is necessary not to lose sight that typical resection, particularly at the elbow and at the shoulder, promise better results from the point of view of function than an uncomplete operation leaving an osseous callus at the lower part of the articular cavity.

There remain, then, two questions for consideration with regard to joint wounds:

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(1) When a purulent infection of an articulation has taken place, how should it be treated?

(2) Joint resection having been judged necessary, is it necessary to follow it with primary suture, or is it better to resort to secondary suture?

(1) The first question has been answered by Doctor Willems who, cutting loose from ancient prejudices, has replaced immobilization by active mobilization. The movements to which a joint is subjected when they are executed by the patient are not painful, and the results produced by this mode of treatment are really remarkable. The suppuration diminishes rapidly and infection disappears and the joint mobility is preserved, even when infection has been profound, with relatively considerable tissue destruction. It is proper to remark, however, that the mobility can give its full return only when its application is watched over by a competent surgeon.

(2) As to whether it is better after articular resection for a war wound to make primary suture or secondary suture, the conditions will vary according to the joint affected. For the elbow and the shoulder, as a rule, it is better to make immediate suture for the end of preserving movement, but as our experience has demonstrated, such a result can rarely be realized. In a large number of cases we have had to resort to secondary suture, or often to permit the wound to heal by secondary intervention.

After resections of the hip and especially after those of the knee, primary suture is dangerous. On account of the impending infection, it is better to leave the wound open, to keep the bony surfaces separated by apparatus, to sterilize the wound according to the method of Carrel and to complete the surgical treatment by secondary suture.

*Chest Wounds.*—Taking up next the question of the closure of penetrating wounds of the chest, that is to say, open pneumothorax. When the thorax is opened, the air rushes into the pleural cavity and the lung contracts upon itself with the result that there is a disturbance of the respiratory equilibrium which may go on even to asphyxia, syncope, and finally death. Generally, however, the respiration becomes reestablished and regular after a certain time through the coöperation of the lung on the sound side. The lung on the wounded side remains contracted in a state of collapse; after a time it loses its elasticity and becomes fixed after a fashion in its new position.

As the result of the inflammatory reaction of the pleura, there is formed a fibrinous layer more or less thick, which encloses the lung and is the source of the impossibility of the lung undergoing physiological expansion. There is thus established between the lung and the parietes a separate cavity which necessarily persists as long as the lung can not be brought into apposition with the thoracic wall. In order to accomplish this have been advised the operations of Estlander, of Schede, of Delorme, and the one which we ourselves have recommended to depress the wall of the thorax by a massive resection of the costal wall.

The general considerations that we have just stated show how important it is to close the thorax immediately after the wounding. The rules which have been adopted by us at our hospital are based essentially upon the idea of securing the suture of the parietes. They are as follows:

(1) If the thorax is widely opened and the lesions recent, and there is persistent hemorrhage from the lung, the indication is to apply hæmostatic suture to that organ, although if the flow of blood is very abundant and the condition of the wounded man is very threatening a tamponade of the pulmonary wound must be resorted to. In order to close the pleural cavity if it is not possible to close the thorax breach by reason of its extent or because of the menace of infection, we apply a special tampon that we have designed which we call "*tamponnement en bouton de chemise*" (shirt button tampon), which makes certain the hermetic sealing of the cavity at the same time that it permits drainage.

The use of local anæsthesia in the course of intervention and in the later dressings is most useful.

(2) If the orifice is narrow but still permits the air to enter, it is necessary as soon as possible to obtain its secure closure in order to stop the progress of the pneumothorax. It should be well understood, however, that, in cases of hemorrhage of the lung a preliminary enlargement of the pleural opening may be necessary in order to treat the pulmonary wound. Occlusion of the thoracic wall is accomplished by the suture *en masse* of the musculocutaneous planes.

(3) If there is present an open pneumothorax, with an already developed pleural infection, the treatment of Carrel is instituted in all cases and as soon as sterilization of the wound has been accomplished the cavity is closed by suture in the musculocutaneous spaces.

Before proceeding to closure it is indispensable to control the sterilization of the pleura by cultures from the exudate. It is necessary, moreover, that the pleural secretion should have become completely dried up. It is only in these conditions that operation may have any chance of success and that it will replace definitively all those methods of intervention, which in order to bring the lung and the parietes into apposition demand more or less resections of the costal wall.

*Wounds of the Abdomen.*—In order to complete our report, we should now speak of suture of the wounds of the abdomen, but such general accord has been established that all surgeons think that early intervention should be resorted to. For the end of permitting us to intervene as early as possible in abdominal lesions; lesions of the thorax or in cases of severe hemorrhage we established at a distance of 2 or 3 kilometres from the front, advanced dressing stations sufficiently well equipped to make possible interventions of urgency. The installation of these posts reduced the mortality in wounds of the abdomen from 65 per cent. to 45 per cent.

## THE TREATMENT OF BURNS

AS EXEMPLIFIED IN THIRTY-TWO CASES

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THE function of this paper is not to give any new or original ideas in the treatment of burns, but rather to set forth our opinion of comparative values of well-known methods of treatment gained from the experience of simultaneously treating 32 cases of severe, extensive, multiple burns of varying degree. During this period we had the opportunity of watching the comparative values of antiseptics, wet and dry dressings, non-interference by leaving the burned area severely alone, open and closed treatment, air, sunlight, and electric light, protectants, such as paraffin and ointments, tissue stimulants, such as balsam of Peru, and surgical assistance, such as skin grafting, burns of apparently the same degree, received under the same conditions, and treated by the same staff of attendants.

The type and method by which the injuries were received may be gained from the following brief history. While coaling a ship a sudden coal dust explosion occurred, shooting a solid sheet of flame through coal bunkers, passage-ways and hatches, enveloping all occupants with an almost complete covering of fire. All the men injured had been coaling ship for several hours and were covered with the usual amount of perspiration, coal dust and dirt, which accumulates during a hard day's work handling coal. Immediately following the injury all men were taken to the ship's hospital, severe cases given morphine sulphate gr.  $\frac{1}{4}$  hypodermically and all burns given an emergency dressing of aqueous solution of picric acid. Patients were then wrapped in blankets and preparations made for transportation to hospital ashore. This necessitated an outdoor exposure of about fifteen minutes, during which time all patients were carefully and fully wrapped in four to five heavy blankets on a warm day.

Patients were received in previously prepared and warmed beds. Great care was executed in transferring patients from stretchers direct to bed. Immediate application of external heat and general measures to prevent and minimize shock at once resorted to. A survey of all cases revealed the following general conditions: All faces were badly burned, swollen beyond recognition, with a mass of blebs, coal dust and dirt. Fig. 1 gives a fair example. The severer cases had large multiple areas of burn covering practically the entire surface of the body. All surfaces heavily laden with coal dust. All patients were in considerable pain.

All complained bitterly of being chilled. Practically all cases commenced to show some evidences of beginning shock.

Our initial treatment was quickly instituted as follows: External heat and body protection was generously provided. Morphine sulphate gr.  $\frac{1}{4}$  repeated if necessary to severe cases. Continuous proctoclysis of normal salt with sodium bicarbonate given to severe cases. It is difficult to draw an adequate picture of this initial appearance. Practically all the faces were a mass of blebs, dirt and burn, accompanied by enormous oedema, closing the eyes tightly and obliterating the usual margins of lips, chin and neck. Our next immediate step was to remove some of the emergency dressings. To all faces we applied a generous smear of boric acid ointment. Gently pried open the eyelids and instilled liquid petrolatum. Areas on the body and extremities having a well fitting dressing, we temporarily allowed to remain, other dressings were carefully removed and a wet dressing of 1 per cent. aqueous picric acid solution applied, patients made comfortable and our efforts directed toward general measures.

The afternoon of admission two cases died—both very extensively and severely burned. Twelve hours following admission three more cases died. These cases, fully two-thirds of body area having been burned, coupled with considerable smoke and fire inhalation. None of them rallied from initial shock—coma and delirium gradually deepening until death.

Twenty-four to thirty-six hours later we had four more deaths. These patients rallied from initial shock only to pass quickly into a secondary depression with suppression of urine, coma and death. Careful use of morphine and continuous rectal drip with salt and sodium bicarbonate, although retained and absorbed in large amounts, seemed of no avail. All the fatal cases ran about the same course, coma, delirium of low type, suppression of urine and temperature rise of  $104^{\circ}$  F. and  $105^{\circ}$  F.—in two cases,  $106^{\circ}$  F.

We lost one other case, a patient, Fig. 2, taken third week, very severely burned on face, neck, entire chest, and back, small area on abdomen, both hands, forearms and legs. Following a stormy and precarious condition, during which period for days we expected a fatal ending, the patient rallied, almost completely recovering from all burns only to be followed by a bronchopneumonia to which patient succumbed on the thirty-seventh day. This case and case number one, also very severely burned, we considered our success, due to the continuous judicious use of morphine in an effort to lessen absorption, and the continuous use of the rectal drip, adding 4 per cent. glucose to our alkaline solutions, which fortunately the patients retained well and absorbed in large quantities.

To recapitulate briefly our general measures:

1. Morphine sulphate on admission to patients in great pain. Later to severe cases, in two of which we attribute in great part their recovery to its



FIG. 1.—Taken on seventh day. Typical initial picture of all faces.



FIG. 2.—Burned on face, neck, entire chest, and back, small area on abdomen, both hands, forearms, and legs.

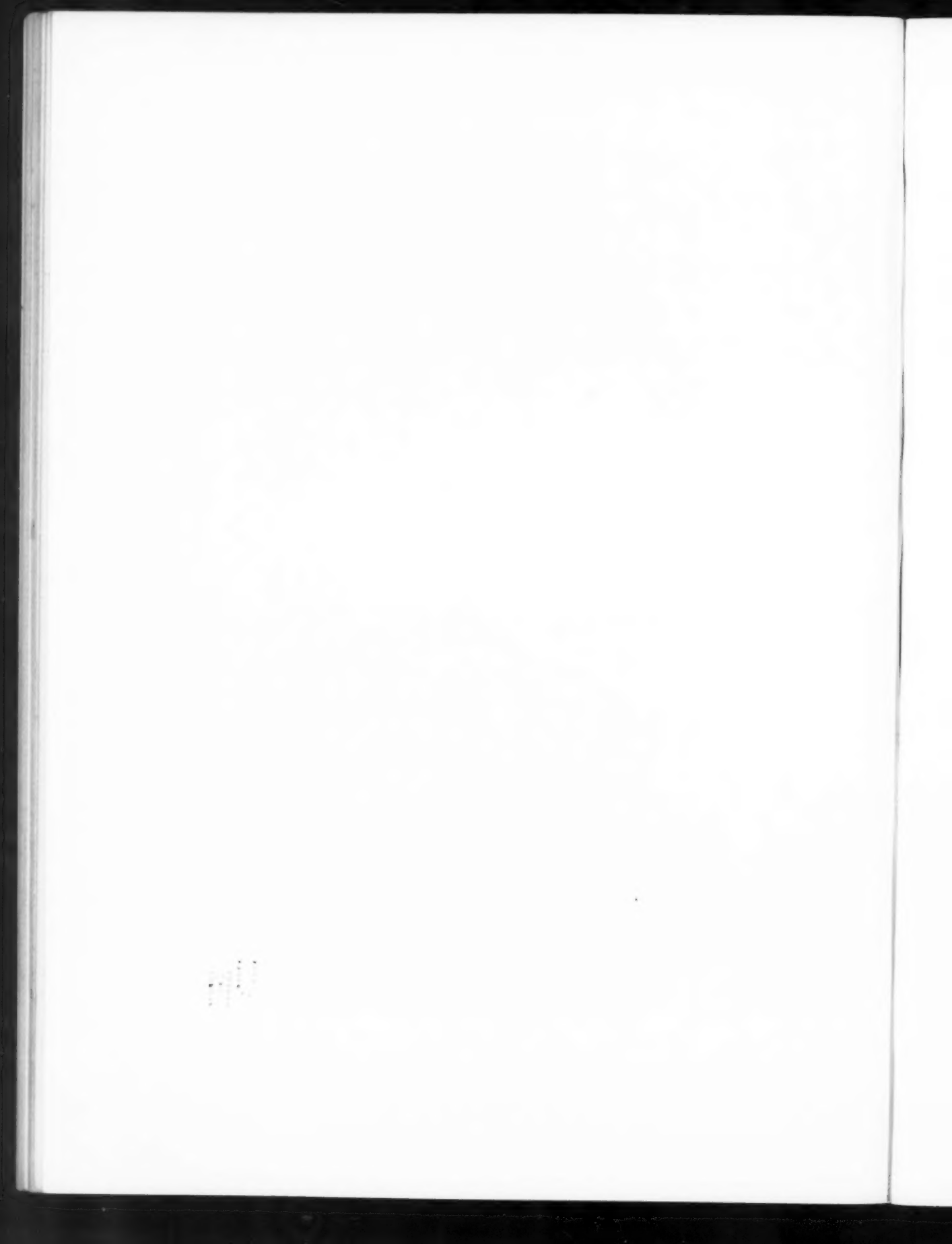




FIG. 3.—Face showing choked-up areas of pus. See Fig. 8 for same patient four weeks later.



FIG. 4.—Entire face cleared except dry elevated patch  $\frac{1}{4}$ -inch high with skin healing arrested beneath.



FIG. 5.—Showing heaped up areas of excrustation. Dry elevation  $\frac{1}{4}$  to  $\frac{1}{2}$  inch with skin healing arrested beneath.



FIG. 6.—Same pathology as Figs. 4 and 5 on face.



FIG. 7.



FIG. 8.—Same patient as Fig. 3. Entire face and hand healed with no scarring.



FIG. 9.—Typical example of results.

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use. These patients we maintained under morphine continuously for a period of two weeks, gr.  $\frac{1}{8}$  night and morning. This amount held patient quiet, comfortable and, we believe, greatly reduced absorption, which at that time was constantly taking place in large quantities, from wide areas of deeply burned, sloughing and infected tissue.

2. Continuous use of normal salt, sodii bicarbonas and 4 per cent. to 8 per cent. glucose by rectum.

3. Large quantities of liquids every two hours by mouth. Milk, egg-nogs, soups, water during the day, and from two to three egg-nogs with the addition of small amounts of whiskey during the night.

4. Later during the fourth and fifth week, when the element of exhaustion, together with the weakening effects of daily dressings, commenced to play an important rôle in Cases I and II, we added to our supportive measures a tonic of phosphorus, strychnine and quinine, to which both patients responded well.

The second day we commenced our local treatment of burned areas. To the faces we applied a light coat of sterile boric acid ointment. Figs. 1 and 3 represent a fair picture of the appearance of all faces at the end of the first week. At this period our method of treatment looked far from encouraging. We had large, swollen, unrecognizable masses, with heaped-up areas of incrustation, beneath which were choked up large quantities of pus. (Fig. 3, yellow areas represent small pockets of excretion beneath brown crusts.)

At this stage it seemed reasonable to assume that gentle removal of these loose crusts, literally floating bodies upon this choked-up pus, would give complete drainage and rapid healing would follow. We divided our cases, in some pursuing the policy of gentle removal of loose crusts, in others we followed the policy of strict non-interference. The pathology proved to be most puzzling and the healing one of the interesting conditions in our series.

In all cases, our carefully picking up these loose, floating crusts with gentle evacuation of exudate was invariably followed by a repetition of the same process, time and time again. The control cases (Figs. 1 and 2) in which the policy of severe non-interference was pursued, looked equally as bad. We continued both lines of treatment. Gradually the non-removal cases slowly cleared with the exception of small areas of large heaped-up incrustations on foreheads, around ears and necks (Figs. 4, 5 and 6) which remained apparently dry and pus free beneath but continued to slowly increase in elevation. Our interference cases continued to excrete and crust up generously over all areas. We then applied the non-interference procedure to them, our results were the same, a slow cleaning up with the exception of isolated areas (Figs. 7 and 8) with enormously heaped-up incrustations. These local areas slowly filled with exudate and it was deemed advisable to remove them when this could be accomplished without any force, but by merely lifting away the loose area,

it was removed. A few days later the old condition reappeared. Removal in due time was again followed by reappearance. There being no heaping up of granulation tissue beneath these patches, and as the areas were small, the patients, some of them, up and around with nice healing over all surfaces, we again adopted a policy of non-interference, believing that in time the skin surface would bridge over and the areas heal. A few weeks experience taught us the following: There seemed to be two separate, distinct periods, at which time, two distinct results occurred, simultaneously, in all cases. The first period in which removal was continuously followed by the same exudative heaping up process. The second period in which following a week's period of non-interference, removal, at this juncture, of the crust with the application of a thin smear of boric acid ointment on lint was followed by a quick bridging over of the raw surface with new skin and complete healing with no scar formation in a few days' time. Following this procedure we finally obtained complete healing, with new skin formation and no contracture, no eversion of eyelids and no disfigurement in our entire series. Figs. 8 and 9. (Figs. 8 and 3, same patient four weeks interval.)

To body surfaces and extremities we instituted a variety of treatment. At the outset two general procedures were decided upon. First, a system of more or less non-interference, with the application of some wet antiseptic dressing in which at daily dressings the strictly loose, free pieces of dead skin were carefully and gently picked away, and no effort made in any way to clean up the surface, every effort being expended to minimize to the utmost, traumatism to the part. The second system of moderate interference in which open, punctured blebs were picked up, the skin carefully snipped away and an effort made to more or less clean up the area.

We believe without question that the less encouraging the burned surface appears during the initial dressings, as far as to macroscopic appearance of dirt, irregularity of surface due to semi-adherent folds of dead skin, etc., the better will be the ultimate result, providing, of course, continuous effort is pursued to clean up any infection present. Our experience also demonstrates the individual value of different applications applied to different type lesions and the great significance of applying the proper dressing to individual type lesions at the proper time. As evidence of this, we received tremendous healing with new skin promotion by the use of wax dressings in some cases, whereas in others, of apparently the same type of lesions, this form of dressing had to be discontinued and our results were obtained by protection with ointment spread on lint with paper strips, or rubber tissue.

Our treatment after the initial relief of pain, obtained by picric acid dressing, may be broadly divided into two great stages. First the cleaning up stage, in which antiseptics were used to clean up the tremendous amount of infection present, and second the protection stage in which the



FIG. 10.—Example of large areas of deeply infected tissue from which tremendous absorption takes place.



FIG. 11.—Entire back. Same patient burned on face, both arms, forearms, hands and entire right leg.

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FIG. 12.—Shoulder and buttocks.

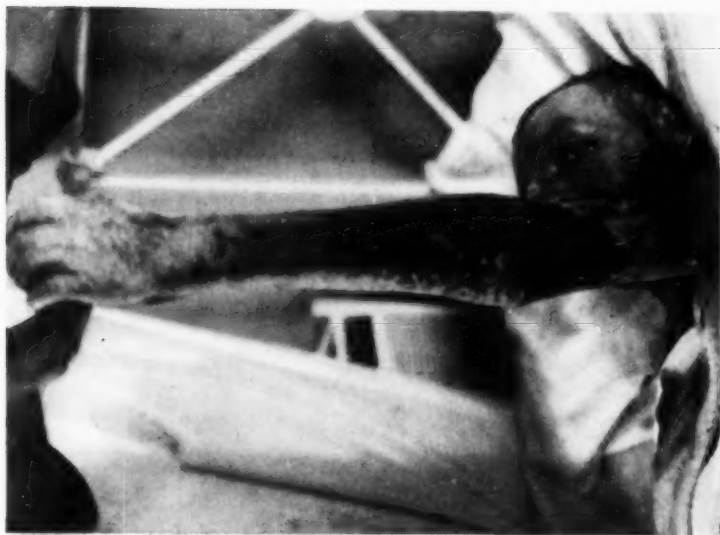


FIG. 13.—Example of extent of burn on arms.

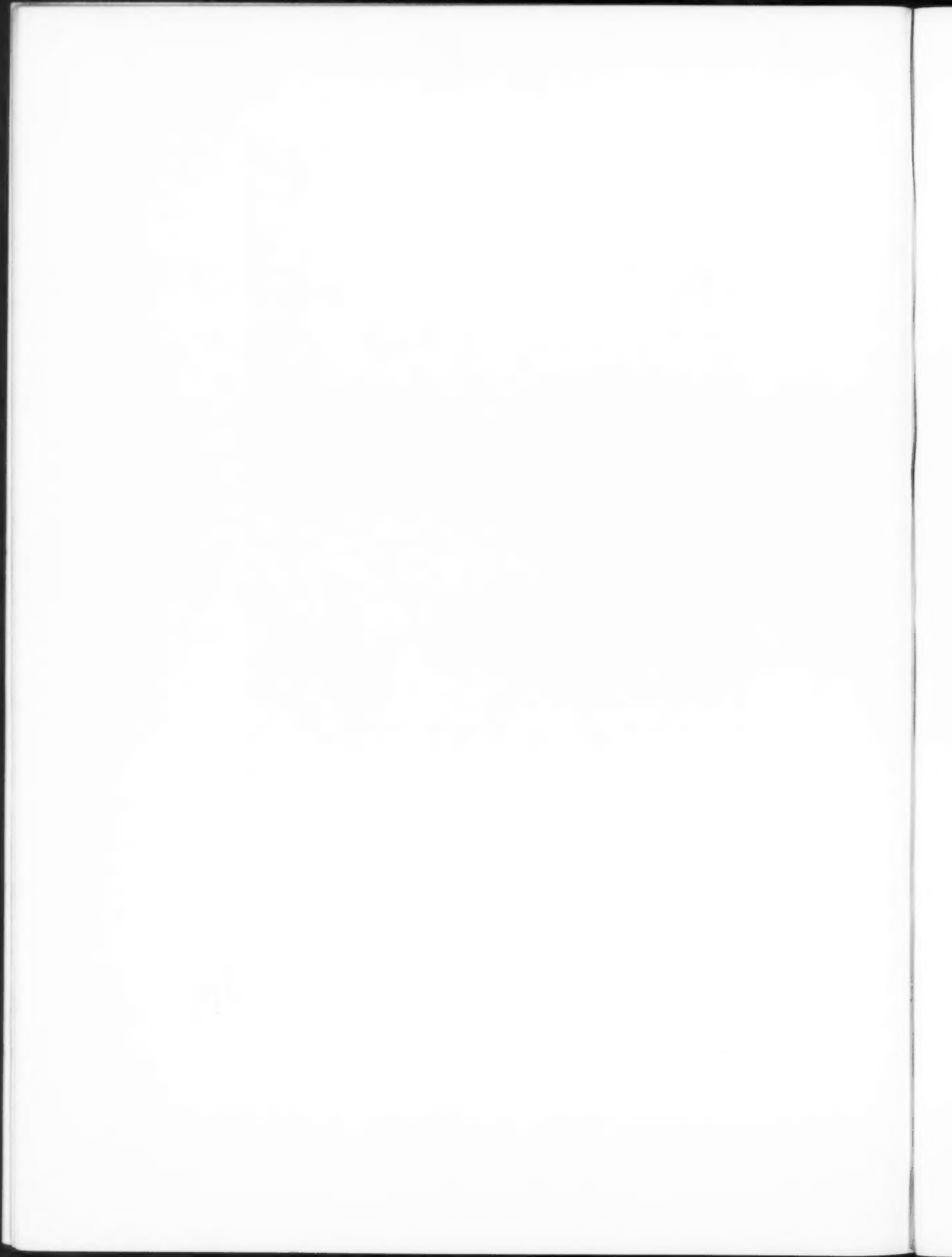




FIG. 14.—Large areas showing results obtained.

PLATE  
XIV  
FIG. 14  
RESULTS  
OBTAINED



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area was carefully protected and nature encouraged to do her part with as much assistance by us as possible, in line with a minimum amount of interference. In the first stage of our non-interference cases we applied wet dressings of dilute alcohol, boric acid solution or normal salt solution. After an initial antiseptic treatment a system of exposure to open air was instituted. This was followed in due course by a simple protection, boric acid ointment on lint or paraffin, and the area rapidly healed. Large body surfaces, such as chest and back, to which the application of wet dressings was impracticable, we applied boric ointment to in thin films, bathed the surface with liquid petrolatum or used paraffin, depending upon the ease with which the patient was able to be dressed, the amount of exposure he tolerated and the amount of damage rendered in removing the type of dressing applied. Liquid petrolatum and paraffin we found very serviceable, but also discovered that each served a well-defined period, after which its usefulness seemed to be impaired, and a change to some other protection, rapidly stimulated skin formation and the area quickly healed. In the large majority of our cases these simple procedures gave excellent results. In the second series of what we will term interference cases, our results were vastly different. Our interference in these cases consisted of gently picking up loose or very easily removable areas of apparently dead tissue. Following this, the cases were given open exposure. During the first week these cases appeared to be far in advance of all others, the areas appeared clean, redundant tissues had all been removed, and apparently healing would quickly follow. We were doomed to disappointment. We soon discovered that the areas were all deeply infected and the cleaning up process was proved to be a slow and difficult one.

We first applied wet dressings of boric acid solution, weak alcohol, or salt solution, depending upon the area, the irritability of patient, his resistance to dressing manipulation and "how the area looked." Some of our cases (Figs. 10, 11, 12, and 13) presented large areas of deeply infected tissue in which, as the patient's general condition gave evidence, the element of absorption, irritation and manipulation exhaustion, was a serious one. To these parts we tried the following procedures—open air, exposure to electric light, boric ointment, liquid petrolatum, paraffin, wet dressings and continuous irrigation.

The following procedures proved most valuable and for stated periods gave the best results: Continuous irrigation with Wright's solution (hypertonic salt), Dakin's solution, normal salt solution, and a modified Dakin's solution (quinine sulphate, 8.00 grammes; hydrochloric acid, 4.00; acetic acid, 40.00; sodium chloride, 140.00; formal (40 per cent.), 8.00; thymol, 2.00; alcohol, 120.00, and equa q.s. for 8000.00 mils) were equally efficacious for their respective periods. It was found that the area cleaned beautifully with Dakin's solution up to a certain period, after which irritation took place and it was then necessary to substitute normal salt

solution for the remainder of the period, this in turn being followed as soon as possible by protection only, given by the application of paraffin or boric acid ointment on a moderately stiff backed dressing—we used lint.

Wright's solution was deemed efficacious in one case in which considerable absorption was going on. Its application to these greatly swollen, raw, infected areas produced a distinct exosmosis, throwing out huge quantities of serum, which aided considerably in allowing nature to overcome the infection. Our method was to apply loose wrinkled gauze over the area and continuously keep this moist, either by a continuous drip arrangement or by periodic applications of solution. Entire dressing was removed and reapplied once in twenty-four hours.

As soon as the area appeared fairly clean, we immediately attempted to substitute plain protection, using paraffin dressing or boric ointment. This substitution or "switching time" for the treatment proved to us to be a very important one. At one stage paraffin applied over the surface, dressing reapplied in some cases every twenty-four hours, in others forty-eight hours, depending on discharge, seemed to be just the proper procedure and produced remarkable results. (Fig. 14, entire back a delicate film of new skin.) Whereas in other cases this same procedure after continued application seemed to be of no value, and substituting a thin film of boric ointment on a fairly solid backed dressing, such as linen or lint, produced the same spreading new skin, over remarkable areas.

In a few cases all of these combined methods failed. It was found that continuous paraffin or ointment protection gave tremendous amounts of discharge with heaping up of granulation tissue and no healing. In these cases cauterization with silver nitrate followed by boric ointment on lint, smoothed down firmly across the area, aided in spreading over the delicate edge of epithelium. We consider the bridge-like action of a gentle but firmly applied piece of ointment protected lint to have an absolute effect in aiding these delicate epithelial cells in their effort to spread over the area, and consider its use directly responsible, together with the paraffin protection method, for our enormous areas of skin re-epithelization and the non-necessity for application of skin grafts.

#### SUMMARY AND CONCLUSIONS

Our experience demonstrated to us the value of the following: The need for the quick institution of immediate general supportive measures in patients suffering from extensive burns. The value of fluids in large quantities by mouth and bowel, even before the so-called toxæmia or acidosis symptoms commence to appear. Later, during the absorption period, from large infected areas, the addition of the continuous use of small doses of morphine sulphate seemed to us to be of distinct advantage. It certainly serves to keep the patient quiet and thereby reserves his energy for later use. Too much stress cannot be laid on the value

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of these general measures, used as a prophylactic procedure, immediately following injury, before the advent of those well-known toxic symptoms, which are sure to follow in one extensively burned. We deem them far more important than any value obtained by laying too much stress upon the burned area during this initial period. It was again proved to us: That patients extensively burned quickly go into a severe shock the first twelve hours. That reaction from this period may be followed by an equally fatal period on about the fourth or fifth day. That recovery from this secondary period is later followed about fourth or fifth week by a period in which the element of exhaustion is a very important consideration.

Our local procedures demonstrated the following: Initial antiseptic cleansing. Alcohol, boric acid solution, salt solution, Dakin's, Wright's solutions all proving equally efficacious. Gentle dressing manipulation during this period with traumatism reduced to a minimum. As soon as possible the application of a simple protectorant, paraffin, ointment, gutta serena or rubber strips.

Our local measures again proved to us: That no one procedure, wet or dry dressing, wax, ointment, or that no one solution proves equally valuable for all cases. That the individual question of how the particular area reacts to the solution used is an important one. That there is a distinct difference between the mild stimulation and healing effect of bland protectants such as wax, liquid petrolatum and vaseline. That the so-called "switching time" in the application of these various dressings is a distinctly important one. That some patients cannot tolerate open-air exposure. That the absolute non-interference and non-removal of semi-adherent tags of skin is usually the best procedure.

## MYXOMA

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"THE myxomata are tumors composed, in the main, of a tissue resembling none found normal in the adult organism, namely, a tissue composed of well-formed isolated cells of a somewhat stellate or polyhedral appearance, giving off delicate processes, the individual cells being separated one from the other by a matrix containing varying amounts of mucin, which takes on a differential stain with thionin. In this matrix there run large but thin-walled vessels. Some leucocytes are also present. We say formed in the main of such tissue, for it is very rarely that we come across what may be termed pure myxoma; in general, areas of the tumor show more condensed fibrous tissue, or cartilaginous masses, or frequently lobules or collection of fat cells, while in other cases portions are of sarcomatous type and show close collections of spindle cells. Thus, many pathologists doubt whether we ought to regard the myxoma as a separate form of tumor, and urge that we should speak rather of myxomatous modification or degeneration of some one or other form of connective-tissue neoplasm—of lipoma, chondroma, or fibroma myxomatodes, rather than of myxolipoma, etc. As such the majority of so-called myxomas must be regarded. But Ribbert has described small pure myxomatous tumors of the endocardium. Further, cases have been recorded as congenital myxoma, the tumors being recognized at the time of birth."<sup>1</sup>

Adami,<sup>2</sup> in writing of congenital myxomas, cites a case reported by Borst of a colossal growth upon the mesentery of a child nine months old. This exhibited extensive lymphangiectasis, to which he ascribes the soft nature of the growth; there were correspondingly dilated blood-vessels. He ascribes the tumor to a persistence and continued growth of the embryonal mucoid tissue of the mesentery.

Bland Sutton<sup>3</sup> says, "It would be convenient and perfectly justifiable to deprive myxomata of even the rank of species among tumors." He exemplifies by citing myxomas springing from lumbar fascia and recurring after removal; in one case there were several recurrences extending over a period of ten years, with no evidence of dissemination.

Mallory<sup>4</sup> defines myxoma as a "tumor of mesenchymal origin of which the cells tend to produce mucin in addition to fibroglia, collagen, and elastic fibrils." He further states it is "a comparatively rare tumor and therefore clinically of minor importance. It is questionable whether it deserves recognition as an entity."

"A true primary myxoma which has its origin from embryonal mucous tissue is rare. Fully developed mucous tissue exists in the embryo only in the umbilical cord. The chief source may be found in

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the early undifferentiated connective tissue of the embryo which has a mucous quality. Such mucous tissue is widely distributed, especially in subcutaneous areas. That many primary myxomas arise from islands of such embryonal tissue.

"Secondary myxomas may develop by degeneration of mesoblastic tumors, such as occurs in fibroma, lipoma, and chondroma.

"That these phenomena may be explained by assuming their origin from islands of mucous tissue which are partly differentiated. Pure myxomas never tend to differentiate into fibroma or lipoma or chondroma.<sup>5</sup>"

MacCallum<sup>6</sup> writes: "Ribbert makes a point of declaring that in those frequent cases in which a complex or teratomatous tumor presents patches of muroid tissue here and there, the myxomatous part is not to be regarded as a secondary degeneration of some other part of the tumor. In other words, he maintains the independence of the myxoma as a distinct tumor which may be combined with cartilage or with bone, etc., to form a myxochondroma or myxoosteoma."

Dennis<sup>7</sup> considers a pure myxoma of rare occurrence; and that irritation leading to a chronic inflammation seems to act as an exciting cause in many cases, examples of which are seen in polypoid growths of the nose and ear in patients in whom a chronic catarrh or otitis has existed for a long time.

Multiple tumors of a myxomatous nature in skin and organs of animals and fowls have been produced by experimental inoculation of a filterable virus.<sup>8</sup>

Composed, as they are, of a type of tissue from which fat tissue is developed in the embryo, the relations of myxomata to fat tissue are very intimate. They are most frequently developed in, and probably directly from, fat tissue. They are also found in the subcutaneous, submucous, and subserous tissue, in the marrow and periosteum; in the brain and cord; in the sheaths and intrafascicular tissue of peripheral nerves; in intermuscular septa; and in the interstitial tissue of glands, such as the mamma and parotid.<sup>9</sup>

Robertson<sup>10</sup> in an analysis of 51 cases of lipoma myxomatodes found that 43 per cent. developed in the muscles of lower extremities, 33 per cent. in the retroperitoneal region, one reached a weight of 65 pounds and 33 per cent. were malignant.

McMahon and Carman<sup>11</sup> claim the röntgen shadows of fibromyxoma of lung are significant. The "increased density is large, massive, homogeneous, and well circumscribed. An entire lobe is usually involved, most commonly the upper."

Estor<sup>12</sup> reports a case of fibromyxoma of small intestine. The tumor was hemispherical in shape, 4 cm. in diameter. Microscopically the tumor was a myxofibroma, which in its superficial part approached the histologic type of pure myxoma; the basal part showed the structure of diffuse fibromyxoma.

In the testis, spermatic cord, and possibly in the kidney myxomas are probably of teratoid origin, and in some other regions, as parotid, breast, they represent mixed tumors.<sup>13</sup>

Adami<sup>14</sup> considers myxomas of kidney rare. Most of tumors described he regards as connective tissue growths that have undergone secondary mucinous degeneration. Bezold and Hallen, however, have each reported a case of true myxoma.

Dabney<sup>15</sup> reports two cases of true myxoma of the rhinopharynx.

Brenner collected 33 cases of cardiac myxomas; 20 of the left auricle; 10 on the heart valves; 2 right ventricle; 1 on the apex.

Ewing<sup>16</sup> believes the tumors develop from superfluous embryonal tissue in the region of foramen ovale.

Curtiss expressed the view that they are not true myxomas; that the nodular outgrowths of the endocardium are due to infection, and mechanical influences stimulate their growth.

Cotton<sup>17</sup> reports a case of myxoma involving the whole shaft of femur from neck to condyles.

Bloodgood<sup>18</sup> reports 5 collected cases of pure myxoma without cysts affecting the medullary cavity of the phalanx.

He further states: "Pure myxomas are rare bone tumors. I have observed one exhibiting itself as an exostosis of the shaft of the humerus; I have seen it combined with cartilage as a multiple lesion arising from the rib, and as a periosteal growth from the os calcis."

He further comments on the above cases: "Myxomatous tissue is not unlike *ostitis fibrosa*. It seems remarkable that the majority of marrow tumors of the phalanges are myxomatous: of the metatarsal or metacarpal, cysts in *ostitis fibrosa*; and of the lower end of the ulna and radius, giant-cell tumors."<sup>19</sup>

In Virchow's "myxoma chorii" there is not only hypertrophy of villi but cystic metamorphosis. This infiltration of the enlarged chorionic villi, with abundant gelatinous fluid, simulates Wharton's jelly. Virchow further recognized a diffuse myxoma of the chorion developing from an increase in the embryonic connective tissue that normally is present between chorion and amnion.<sup>20</sup>

Other structures of the body are susceptible to pure myxoma. Many case reports affecting the nervous system, brain, ulnar nerve, and many of the optic nerve. Winogradow reports a case of myxoma of the thymus gland; Ewing of the placenta and a cystic myxoma of the umbilical cord and navel measuring 10 cm. in diameter. Virchow reports myxoma of labium which recurred and eventually produced many myxomatous metastases. Ewing aptly says "the interpretation of any one of these tumors should be influenced by our knowledge of the entire group."

In reporting the following case, attention is directed to these salient features: the tumor represents a true myxoma; its unusual location; the



FIG. 1.—Pure myxoma of labium majus. Weight, 7 pounds, diameter, 8 inches. Note attachment to pubic area by broad pedicle.

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disparity in size with usual pure myxoma; the slow growth with the absence of pain; and the reflex disturbances it produced in the causation of frontal headaches and indigestion. Agreeing with the later writers of pathology I am convinced that pure myxoma should be classified as an entity.

Miss W., American, aged fifty, weight 135 pounds, single, nervous temperament, both family and personal history negative; has suffered from frontal headaches and indigestion for past year.

Five years ago noticed a small tumor on right labia, upper third. This has steadily increased in size to present extent (Fig. 1). Never has caused any pain and is insensitive to manipulation or pressure.

Excision of tumor March 28, 1918. The tumor encroached upon the pubic bone and infiltrated the surrounding soft tissues.

Her convalescence was interrupted on the eighth day by a secondary hemorrhage. Some suppuration ensued. The wound healed and she was discharged three weeks later with some inflammatory thickening of labia.

*Examination* (three months later).—Parts normal, weight 156 pounds, headaches ceased. Letter received from her April 29, 1919. States: No headaches since operation, no recurrence, weight 177 pounds.

*Pathological Report* (Dr. Hindman).—Tumor, weight seven pounds, diameters eight inches. Entire tumor, on incision, reveals the characteristic soft gelatinous mass of pure myxoma. Different microscopical sections show a typical primary myxoma with some included glandular structure and a slight round-cell infiltration at periphery.

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## FIBROMA OF THE INTERNAL OBLIQUE AND TRANSVERSALIS MUSCLES\*

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A WOMAN, twenty-eight years of age, was admitted to Bellevue Hospital, January 13, 1919. She had a pendulous growth, about 11 by 8 cm., growing apparently from the crest of the iliac bone. The growth started about three years ago, as a small tumor of the size of a walnut. It has steadily increased in size up to the present. There was no pain except that when the weather changed the patient felt a sticking pain which did not radiate.

On the right side just above the anterior superior spine of the ilium was a tumor, 11 cm. by 8 cm. extending about 2.5 cm. to the right of the ilium. The skin was movable over the tumor. The tumor was slightly movable on underlying tissues.

*Operation.*—An incision was made 8 cm. in length in the direction of the fibres of the external oblique muscle from above across to the rim of the external inguinal ring. The tumor was found growing in the fibres of the internal oblique and transversalis muscles. The external oblique was not adherent to it. The tumor was excised, removing with it some of the muscle and some of the sheath of the rectus. The character of the tumor was hard and apparently of a fibrous nature, probably a fibromyoma of the internal oblique and transversalis. The peritoneum was of necessity opened in two places. The uterus and appendix were examined and found to be normal, except that there was a small fibrous nodule near the cervix. After examination of the appendix and uterus, the peritoneum was closed with chromic gut sutures. The edge of the rectus was pulled over and sutured to the origin of the internal oblique and transversalis, thus closing over the large defect made by the removal of the tumor. The external oblique was then closed in the ordinary manner of the McBurney incision, using interrupted chromic gut sutures and overlapping the edges. The skin was closed by interrupted sutures.

On section the tumor appeared hard and was pale yellowish pink and had the appearance of a fibroma. It was 11 cm. long and 9 cm. wide by 7 cm. in thickness. There was no pedicle to it. In removing it several large vessels had to be ligated.

*Examination* (by Dr. John McWhorter, Pathologist).—Macroscopical examination: The section consisted of a circumscribed, apparently encapsulated mass, 12 x 6 x 10 cm. The outer surface had a somewhat nodular appearance, was of a greenish color and appeared to be covered by a thin membrane. On section the tumor was dense, the cut surface was of a whitish color, and was

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\* Presented before the N. Y. Surgical Society, March 12, 1919.



FIG. 1.



FIG. 2.

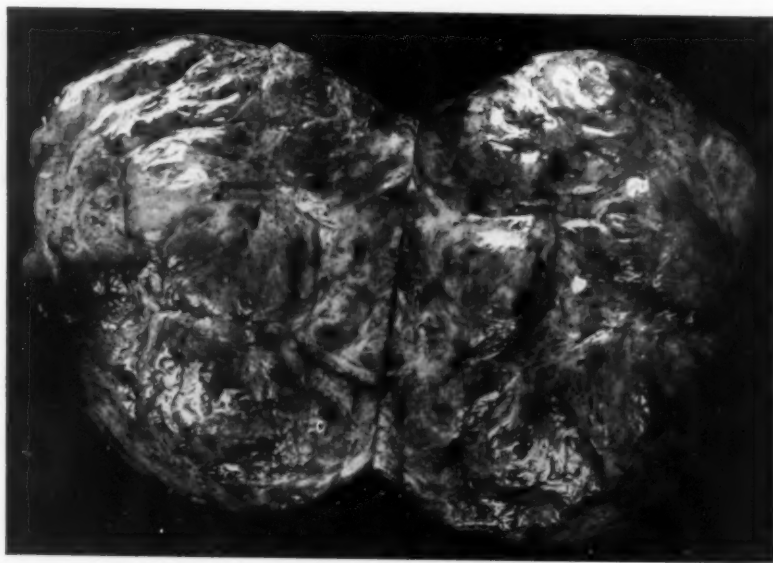


FIG. 3.

## FIBROMA OF THE ABDOMINAL MUSCLES

made up of a series of nodules which were regular in shape and separated one from the other. Microscopical examination: The section showed a mass of connective tissue which was surrounded by a capsule. The connective tissue consisted of a dense mass of interwoven fibers, which extended throughout the whole specimen. In a number of very small areas the connective tissue had a somewhat cellular appearance. The tumor as a whole was moderately vascular. Diagnosis: Fibroma.

In the third volume of the "Précis de Pathologie Chirurgicale," to which Duval, Lecène, Gosset and Lenormant have contributed, there is an excellent discussion on fibromata of the abdominal wall. They report that these have been described by Huguier and well studied by Guyon in 1876-1877, and Labbé and Remy in 1888.

The authors go on to say they are encountered almost exclusively in women during the period of sexual activity. Out of 100 cases observed only 4 were in men. Senn, in his work on the Pathology and Surgical Treatment of Tumors, in speaking of fibromata of the abdominal wall, says of 42 cases collected by Guerrien there were 39 women and 3 men. Of 70 cases of tumor of the abdominal wall collected by Sängér, 60 were fibromata. The efforts of childbirth, aided by strains of the aponeuroses appear to play a rôle in the production of these tumors, according to the majority of writers.

The fibromata observed are almost always single. Their place of most frequent development is the region of the rectus muscle and the inguinal region. (One other case I have observed was in the right inguinal region rather high up.)

The fibroma is always under the superficial aponeurosis. It is often fused with the aponeurosis and with the peritoneum. This last fact was also noted by the elder Senn, who reported four such tumors (Senn, Pathology and Surgical Treatment of Tumors, 1895).

"The majority of writers have insisted that they were encapsulated, a fact which permitted peeling them out. Lecène and Delamare have recently published facts which contradict this classic opinion, and conclude from their observations that the fibromata of the abdominal wall are not always in the whole extent of their circumference enucleable: There always exists a more or less extended surface where the tumor fuses itself with the muscle and aponeurosis, and even infiltrates them by taking the place of muscular elements." (In this case presented this evening this had taken place. The tumor appeared to have the muscular fibre running right into it.)

"Never have they been able to confirm either anatomically or by operation the existence of a vascular pedicle attaching the tumor to the iliac bone or to the ribs. Secondary adhesions to the bone have perhaps been observed" (Guyon).

"Histologically the fibromata of the abdominal wall are pure fibromata, slightly vascular, of which on the surface of the tumor one has been able to encounter enormous veins."

Exceptionally cellular elements have been demonstrated, making one think of fibrosarcoma in part of the tumor. "The fibroma infiltrates itself in the muscles and destroys them, in the meanwhile substituting itself progressively in place of the striated muscle fibres, which explains the possibility of a recurrence at the site of an incomplete extirpation" (Lecène and Delamare).

According to Senn: "Great confusion has existed in regard to the proper classification of these tumors. Some authors are inclined to regard them as a variety of fascial sarcoma. . . . They seldom recur after thorough extirpation and their histological structure bears a closer resemblance to fibroma and keloid than to sarcoma. To distinguish them from ordinary fibroma it is well to retain the name *desmoid*, a term applied by Müller to benign connective-tissue tumors."

*Pathogenesis.*—Huguier and Nélaton maintain the osteoperiosteal origin of the tumor. But it is demonstrated that the pedicle of the osseous insertion does not exist. (In my case there was no periosteal connection.)

"Labbé and Remy after Guyon have thought that there occurred exuberant fibrous cicatrices following muscular tears produced by the efforts of childbirth."

As opposed to the theory that they develop in the round ligament it may be said that they do not always occur in this region.

"The prognosis is fairly good for it so happens that the benign tumor does not recur if its extirpation has been quite complete."

(The removal should be by resection keeping well outside of the tumor mass. This leaves a large defect in the abdominal wall to be repaired by layers after the manner of a ventral hernia.)

## UMBILICAL TERATOMA

A REPORT OF A CASE CONTAINING PANCREAS AND INTESTINE

By BARNEY BROOKS, M.D.

OF ST. LOUIS, MISSOURI

(From the Department of Surgery, Washington University Medical School)

THE following case seems to be sufficiently unique to justify its being recorded:

The patient was a male child, aged two years and four months, who was admitted to the St. Louis Children's Hospital March 26, 1919, for treatment of an ulceration and persistent watery discharge from the umbilicus. The child had always been well except for an attack of diarrhoea in September, 1918, which cleared up promptly after regulation of diet. When the patient was approximately one year old, the mother first noticed an ulceration about the umbilicus associated with a constant discharge of a thin colorless fluid. The ulceration had never healed and the discharge had been continuous.

Examination revealed a healthy child with no abnormalities except those referable to the umbilicus. The umbilicus was replaced by an ulcer approximately 1 x 2 cm. The outline of the ulcer was that of a triangle with the base superior and the apex toward the symphysis pubis. The superior margin of the ulcer was overhanging. The lateral margins were sloping. The edge of the epithelium was serrated but always abrupt. There was no visible growth of epithelium over the base of the ulcer. The base of the ulcer was a brownish-red color, and bled after slight injury. Under the overhanging superior margin of the ulcer was a small sinus into which a probe could be passed for a distance of 3 cm. There was a constant discharge of a thin watery fluid from the sinus. The freely secreted fluid was colorless and odorless, but gauze dressings which had been in contact with the wound for twenty-four hours were stained a dark brown color and had an odor distinctly like intestinal contents. The amount of fluid discharged was not measured; it was only enough to keep a small gauze dressing moist. No chemical examination of the fluid was made.

At operation, an elliptical incision, with the larger diameter transverse, was made about the ulcerating area on the abdominal wall. The incision was carried through the subcutaneous tissue and the anterior sheaths of the recti muscles were opened by transverse incisions. The muscles were retracted laterally and the peritoneum was opened. On the peritoneal surface of the umbilical region there was a spherical tumor approximately 2 cm. in diameter. There was no visible connection of this tumor with any other structure. Owing to the fact that the operation was done in the presence of a chronic ulceration no extensive exploration of the

abdomen to determine the presence or absence of a Meckel's diverticulum could be carried out. The tumor, sinus, and ulcer were excised in one piece. The wound was closed in the manner of closure of an umbilical hernia, except that a small drain was placed in the subcutaneous tissue.

Following operation there was a mild wound infection which healed slowly and the patient was discharged well.

Examination of the specimen removed at operation showed the ulcerating surface as previously described (Fig. 1). On the peritoneal surface opposite the ulcer was a spherical tumor 2 cm. in diameter (Fig. 2). The peritoneal surface of the tumor resembled the peritoneal surface of a loop of intestine. A probe passed into the sinus in the ulcer entered the tumor. The tissue was hardened in formalin before cutting. On section the similarity of the tumor to tissue of the gastro-intestinal tract was clearly revealed. The relation of the different elements of the tumor is shown in the photograph of the section of the specimen (Fig. 3).

Microscopical examination showed the spherical tumor to be composed of tissues corresponding to those forming normal intestine. Peritoneum, muscle, nerve cells, submucosa, lymphoid nodules, and mucosa were all present in their usual relations. The mucosa corresponded in the character of cells and arrangement of the glands to the mucosa of the normal duodenum (Fig. 4). A few of the epithelial cells of the deeper glands took the eosin stain but in no instance were the staining properties of, and arrangement of, these cells such as to suggest the correspondence to gastric mucosa. There was evidence of chronic inflammatory disease particularly shown by a diffuse infiltration of the submucosa by eosinophilic polymorphonuclear leucocytes.

In the wall of the tumor adjacent to the peritoneum was a small island of normal pancreas. The gland was lobulated. The arrangement of the acini and ducts was the same as that of the normal pancreas. The external opening of the main duct was not found. There were a large number of typically normal islands of Langerhans in the pancreatic tissue (Fig. 5).

This case in which an isolated miniature intestinal apparatus was found at the umbilicus undoubtedly is an instance in which the omphalo-mesenteric duct failed to disappear entirely. Such cases are not exceedingly uncommon. The remnant of the omphalo-mesenteric duct, however, usually manifests itself as a Meckel's diverticulum or a sinus at the umbilicus lined with epithelium similar to that lining the intestine. In a few instances it has been found that the epithelium of a congenital umbilical sinus is similar to the gastric mucosa, and in at least two instances (Tillmans<sup>1</sup> and Denucé<sup>2</sup>), the fluid secreted has been found to be similar to gastric juice. Instances of accessory pancreatic tissue are also not rare. Opie<sup>3</sup> found ten instances in eighteen hundred autopsies performed at the Johns Hopkins Hospital in which one or more accessory

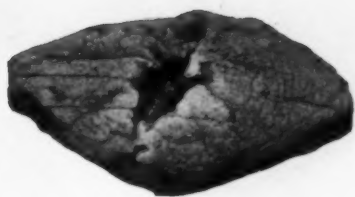


FIG. 1.—Photograph of the ventral surface of the tissue removed at operation, showing the ulcer which has replaced the umbilicus.

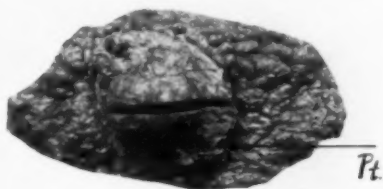


FIG. 2.—Photograph of the dorsal surface of the tissue removed at operation, showing the spherical tumor which projected into the peritoneal cavity. *Pt.*, cut edge of the peritoneum.

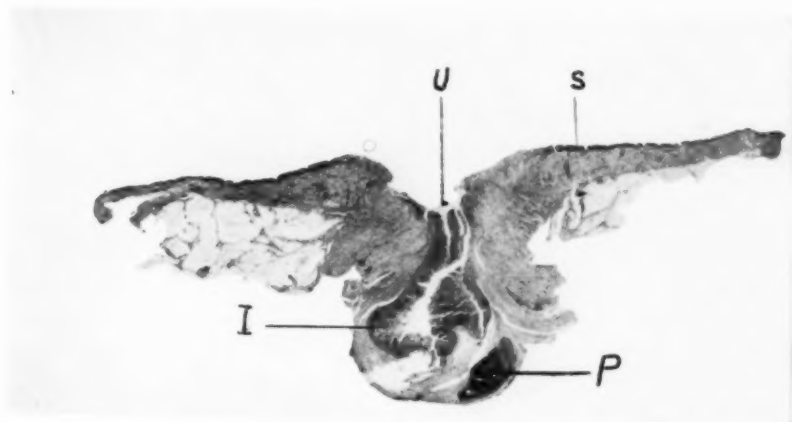


FIG. 3.—Transverse section through the ulcer, fistula, and tumor. U, ulcer. S, skin. I, intestine. P, pancreas.



FIG. 4.—Photomicrograph showing the character of the mucosa of the intestinal portion of the tumor.

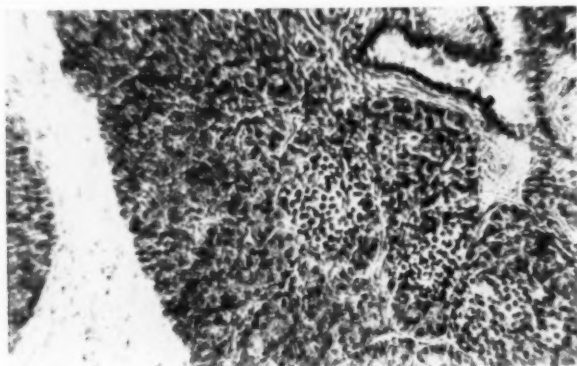


FIG. 5.—Photomicrograph of a portion of the pancreatic tissue, showing the gland acini, a duct, and islands of Langerhans.

pancreatic glands were present. Such isolated islands of pancreatic tissue are usually found in the wall of the gastro-intestinal tract in the region of the normally placed gland. Not uncommonly an aberrant pancreas is found in the tip of an intestinal diverticulum, and in at least four instances it has been believed that the diverticula containing the aberrant pancreatic tissue were true Meckel's diverticula. Zenker,<sup>4</sup> Albrecht,<sup>5</sup> Brünner,<sup>6</sup> Dévé.<sup>7</sup> Neumann<sup>8</sup> expressed the view that an accessory pancreas could not occupy the summit of a diverticulum formed as a result of a persistent part of the omphalo-mesenteric duct because the pancreas did not begin to form until the omphalo-mesenteric duct had already been developed. He believed that a diverticulum having aberrant pancreas at the tip developed as a result of the traction of the aberrant gland on the intestinal wall. Nauwerk<sup>9</sup> and Hansemann<sup>10</sup> concur in this view. It would seem that the instance described in this paper would prove that aberrant pancreas does exist in a persistent portion of the omphalo-mesenteric duct.

Wright<sup>11</sup> has described a case in which aberrant pancreas was found in the region of the umbilicus. The patient in whom this congenital anomaly occurred was a female child of twelve years of age, who had had an umbilical fistula since birth. Two surgical operations had failed to close the fistula. It was finally successfully treated by a complete excision of the entire fistulous tract. At the operation the peritoneal cavity was opened and no connection of the fistula with intestine could be made out. Examination of the tissue removed at operation showed a small nodule of pancreatic tissue imbedded in fibrous tissue near the summit of the umbilical sinus. No tissue similar to intestinal mucosa was found. It is possible that Wright's case was originally identical with the one reported in this paper and that the intestinal mucosa was destroyed at the previous surgical operations.

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A CASE IN WHICH FOR OVER THIRTY-FIVE YEARS A WOMAN  
DEFECATED AND URINATED, AND FOR ELEVEN  
YEARS MENSTRUATED BY THE RECTUM

By WILLIAM W. KEEN, M.D.

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A CASE in which for over thirty-five years a woman defecated and urinated, and for eleven years menstruated by the rectum is worthy of a final record as an evidence of the possibilities of surgery and especially of the conclusive evidence it affords that the rectum can be utilized as a common cloaca for the urine and the menstrual flow as well as for the fæces for an indefinite period.

The condition necessitating this novel use of the rectum was a case of extensive and incurable vesico-vaginal and recto-vaginal fistulæ caused by sloughing as a complication of typhoid fever. Ultimately I entirely closed the vaginal outlet.

I first reported the case publicly in my Toner lecture delivered at the Smithsonian Institution in Washington on February 17, 1876. It appeared in print in March, 1877.

In February, 1876, she had been entirely cured for seven weeks. When the lecture was printed she had remained cured for fifteen months. At her death, May 24, 1911, she had been cured for thirty-five years and five months.

In *Surgery, Gynecology and Obstetrics* (1917, vol. xxv, p. 391) Reuben Peterson has assembled 38 other similar cases in addition to two of his own, making 41 in all.

When my Toner lecture was delivered, February 17, 1876, only one similar case, by I. Baker Brown, had ever been published (*Trans. Obstet. Soc.*, London, 1864, v, p. 25). Of this I was ignorant. So far as I then knew I was the pioneer. I first learned of Baker Brown's case in January, 1919, when I found it in Peterson's paper.

In 1851, Maisonneuve had performed this operation for the first time, but it was not published until 1889. Rose had operated on three cases in 1872, 1883, and 1886, but they were published, one case in 1878, and the other two in 1903.

In 1898, in my "Surgical Complications and Sequels of Typhoid Fever," p. 80, I republished the case bringing the history up to the end of 1897. The present record carries it down fourteen years longer and up to the time of her death.

It is the only one of the 41 cases caused by typhoid fever. In 33 cases in

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\* Read before the American Surgical Association in Atlantic City, June, 1919.

## PERMANENT RECTAL CLOACA

which the cause of the condition was stated, 25 resulted from childbirth, and 4 from operations for cancer.

A brief abstract of the case as published in my Toner lecture in 1876 and in my book on the surgery of typhoid fever in 1898 and my later notes is as follows:

Mrs. M. D., thirty-five years old, first came under my observation in St. Mary's Hospital, Philadelphia, in 1873. In 1872 she nursed her husband in a fatal attack of typhoid fever and then fell ill of the same disease. About the fourth week the labia minora sloughed away and both urine and faeces escaped through the vagina. In October, 1872, she entered the hospital under the care of my colleague Doctor Grove. He tried three times unsuccessfully to close the fistulæ by plastic operations. When I succeeded to his service I also made three equally unsuccessful attempts. In December, 1875, being convinced of the impossibility of success, I proposed to her a, to me, wholly novel operation, *viz.*, the absolute closure of the vagina, leaving the fistulæ wide open. This would compel the urine and the menstrual blood to be voided through the rectum. I explained the operation and its consequences to herself physically and as to marriage very frankly to her. She at once accepted my proposition.

The operation was a success except at the anterior end of the cicatrix, which held everywhere else but failed at the internal end of what was left of the urethra, the vesical end of which had sloughed away. Several minor but always unsuccessful operations were done here. Finally, on December 28, 1875, I excised this small remnant of the urethra. This was her twelfth operation and was entirely successful. She had urinated, menstruated and defecated with entire comfort for seven weeks when I delivered the Toner lecture and described her case in full, February 17, 1876.

She had been a nurse and for nearly four years had been unable to earn a living. She had been socially and professionally a pariah by reason of the disgusting atmosphere in which she lived and moved. This successful operation restored her to her social world and to her means of earning a living. She urinated once or twice at night and five or six times during the day. Menstruation ceased in 1887, over eleven years after the operation.

After the operation fistulæ in the cicatrix broke out in 1877, 1896, and 1904, *i.e.*, at intervals of 2, 19, and 8 years, respectively. Usually they caused only a little leakage and only when in the erect posture. Once the fistula healed spontaneously, once after a minor operation. The third occurred in 1904 as follows:

In 1904, another small fistula appeared. However, as she was so slightly inconvenienced and as the escaping urine caused no odor about her person she did not consult me for two years. In October, 1906, at my suggestion, she entered the Jefferson Hospital under the care of Dr. Francis T. Stewart and Dr. F. H. Maier. They laid open several small pockets containing urinary concretions. This entirely relieved her.

In December, 1888, thirteen years after the vaginal closure, she sought my help and stated that the escape of urine was intermittent. Digital examination by the rectum showed that the recto-vaginal fistula had so contracted that it would only admit the tip of the finger. It also showed that there was a calculus in the vagina which acted like a ball valve and explained the intermittent urinary flow. By inserting a curved hæmostatic forceps I easily crushed the calculus. This consisted of urinary salts deposited on a small mass of fæces.

At the date of her death on May 24, 1911, at the age of seventy-three, she had remained dry and well, with the exception noted, for thirty-five years and five months after the closure of the vaginal outlet. During all this long period she urinated only once or twice at night and five or six times during the day. She was wholly satisfied with the result of her persistent optimism.

No ascending renal, vesical or uterine infection occurred at any time, nor did mucous membrane of the rectum at any time resent the constant presence of the urine or the periodical presence of the menstrual blood.

## VAGINAL HERNIA \*

By HORATIO B. SWEETSER, M.D.

OF MINNEAPOLIS, MINN.

JUDGING from the very few cases reported, vaginal hernia must be of extremely rare occurrence, and for this reason I wish to put on record, as of interest, the following case:

Miss E. B., aged twenty-one years, white, single, waitress, was admitted to the Minneapolis City Hospital September 27, 1915. Her only complaint was the presence of a swelling which protruded from the posterior wall of the vagina at the perineal junction when she stood or strained, but which almost disappeared when lying down and relaxed. It interfered with her working, and, although it was painful, she had suffered no severe sudden attacks of pain. It was first noticed one year before while she was still in bed convalescing from a severe attack of typhoid fever, and since that time it had gradually increased in size. Aside from this attack of typhoid fever the only other factor in her history which might have a bearing on the etiology of the lesion was that, two years ago she had had both Fallopian tubes and appendix removed, probably for pyosalpinx; unknown whether vaginal drainage was employed.

Menstruation began at ten years of age, was irregular but without pain, usually lasted four or five days, and the last period was two weeks before admission. She had never been pregnant.

There was nothing of significance in her family history.

*Physical Examination.*—She was a well-nourished and rather stout girl with well-developed muscles. The abdominal wall was firm and presented a linear suprapubic scar five inches long in the middle line which was firmly healed and showed no hernial protrusion. There was no tenderness nor rigidity and no evidence of tumor.

The vaginal orifice was very much relaxed, and, upon straining and especially when in the upright position, the posterior wall projected through it in the middle line to the size of a small orange, exactly simulating a large rectocele; the perineum, however, was intact (Fig. 1). The rectum itself was not examined until the time of operation. When she lay on her back and ceased straining, the swelling became small and almost disappeared. Examination of the pelvic cavity per vagina showed the uterus in normal position and not prolapsed, the cervix small and the os virginal. There was no cystocele, and the adnexa were not palpable. There was no tumor to be felt in the pelvis.

*Operation* (October 2, 1915).—Under anæsthesia, examination of

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\* Read before Western Surgical Association, Chicago, December, 1918.

rectum revealed the fact that it was not prolapsed at all into the apparent rectocele, and took no part in the formation of the swelling.

A transverse incision was made at the muco-cutaneous junction of the perineum, and a vertical median one up the posterior wall of the vagina and the flaps dissected back. The tumor wall, which was later found to be peritoneum, was very thin and was easily separated from the anterior rectal wall. The dissection was carried up to the level of the recto-uterine pouch behind the cervix. The sac was then opened and a large amount of yellowish fluid drained off, estimated at about a pint. No bowel coils appeared. Not being able to make out what the conditions were which we were encountering, the lower field was abandoned at this point, and the abdomen opened above the pubes. The omentum was found firmly attached to the uterus and broad ligaments. The tubes were absent. The ovaries were small and full of small cysts. When the omentum was detached and the coils of bowel separated, and the uterus drawn forward, an opening was discovered in the centre of the Douglas pouch, about one inch in diameter, through which the finger could be passed into the cyst below. There was no cyst wall above. The opening was closed by sutures including the sacro-uterine ligaments. The abdomen was closed without drain. Returning to the vagina the sac was twisted into a cord, tied and cut off, and the levator muscles sutured over the stump. The redundant vaginal wall was excised and the edges sutured. Fig. 2 is a sagittal view, showing the hernial sac as it dissected the recto-vaginal wall and projected from the vulva. Fig. 3 is a view from above, showing opening from cul-de-sac into hernial sac; closed by sutures at operation.

The patient left the hospital three weeks later, with the parts firmly healed. I have tried to trace her in order to report her present condition, but have not succeeded.

In seeking for an explanation of the conditions found, *viz.*, a hernial sac containing fluid but no intestine or other viscera, my theory is that at the operation for removal of the tubes the fibrous floor of the cul-de-sac was injured, and that at the same time there had developed a pelvic peritonitis which formed adhesions between the coils of bowel and the omentum, creating an encysted collection of fluid at the bottom of the cul-de-sac, the pressure of which caused a pouching downward of the peritoneum. That a year later, when she suffered the severe attack of typhoid, the tissues relaxed and allowed a protrusion of the hernial sac, into which the bowel could not enter because of the adhesions which held them up. Possibly a better and more probable explanation is to assume that the supposed typhoid fever attack was not typhoid at all, but rather a severe pelvic peritonitis which caused the encysted fluid to increase in quantity and in pressure, and that in this way the hernia developed rapidly, and travelled along the recto-vaginal plane, appearing at the perineum.



FIG. 1.



FIG. 2.

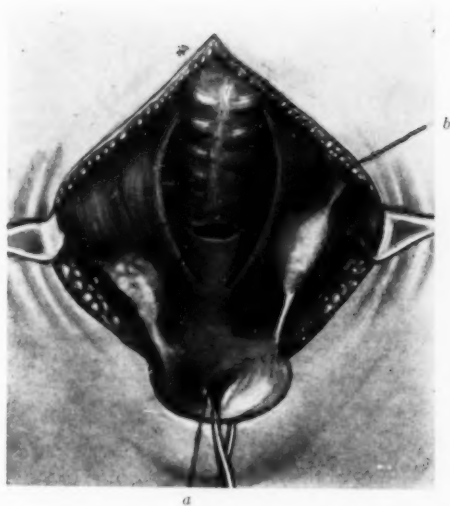


FIG. 3.—*a*, uterus drawn forward; *b*, hernial opening.

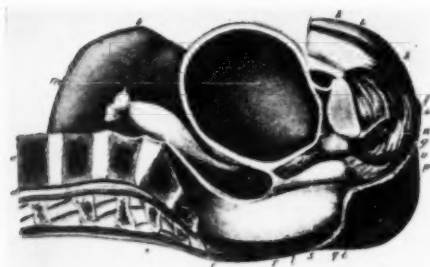


FIG. 4.—Astley Cooper's "hernia," 1804.

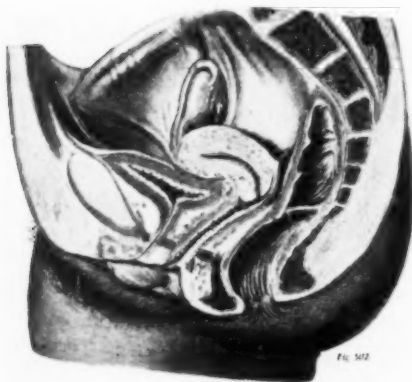


FIG. 5.—Sabotta's anatomy.

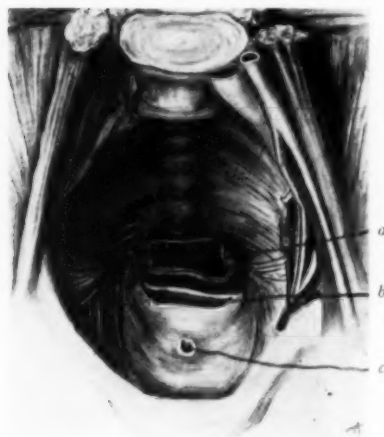


FIG. 6.—Dissection by Dr. L. A. Calkins. *a*, rectal opening; *b*, vaginal opening; *c*, urethral opening.

## VAGINAL HERNIA

Very few cases of true vaginal hernia have been recorded, and fewer still have been operated on or come to dissection post-mortem. Barker states that no case was recorded in the first sixteen volumes of the "Transactions of the London Obstetrical Society." Most of the works on gynecology do not mention it at all; a few give it very scant notice, under the heading of pudendal and perineal hernia. Even works on hernia pass it by with very little comment. A search of the index of the Surgeon General's Office brings to light only a few articles, and these refer, more or less, to the same cases. It is difficult, therefore, to get a true idea of the pathology and pathogenesis, and of the proper course to pursue when dealing with them.

Sir Astley Cooper, in his classic work on hernia, published in 1804, reproduces a very clear and distinctive drawing which he made from a post-mortem specimen from a male subject. The course of the sac along the anterior rectal plane and its appearance in the perineum is so exactly similar to my case, making allowance for anatomical difference of sex, that I have taken the liberty of reproducing it. There is no history attached, the specimen having been found accidentally in the dissecting room. Fig. 4 was reproduced from Cooper's work on hernia (1804). Fig. 5 was reproduced from Sabotta, showing normal female sagittal section of pelvis.

Fordyce Barker, in an exhaustive article written in 1876, reported four cases, none fatal and none operated upon.

Gaillard Thomas, in 1885, in the course of an extensive paper, reports and illustrates a case of vaginal enterocele in which he opened the abdomen, caught the bottom of the sac with a long forceps, inverted and sewed it to the anterior abdominal wall and succeeded in curing his patient.

In recent years the only case I have been able to find is one reported by H. Hartman, in 1916, in a French journal (*Ann. de gynec. et d. obst.*), and abstracted in *Surgery, Gynecology and Obstetrics* of May, 1917. In his case the sac projected from the posterior wall of the vagina, but did not reach to the vulva. He operated entirely from below, excising the sac at the level of the uterine neck, and suturing the muscular floor below the stump. His patient had been operated on several times previously for supposed prolapse, always with return of the tumor, and he makes the statement that it is necessary, to prevent recurrence, that the sac must be excised and the vaginal wall reconstructed.

At first thought one would assume that the floor of the pelvis ought to be the favorite site for the occurrence of hernia, for the reasons that it lies at the bottom of the abdominal cavity where the intra-abdominal pressure is presumably greatest, is perforated by many small openings for the passage of blood-vessels and nerves and by the large openings for the urethra, vagina and rectum, and presents not infrequently defects in the muscular floor as pointed out by Ebner (25 in 60 cases examined). It

therefore appears quite remarkable that so few cases are on record. The explanation is two-fold, as pointed out by Sir Astley Cooper and C. Aston Key, many years ago: (1) The obliquity of the pelvic cavity is such that the intra-abdominal pressure is deflected from it and expended largely on the pubic bone and the anterior abdominal wall in the lower iliac regions, and (2) the pelvic floor is protected by the very strong pelvic and recto-vesical fasciæ, the fibres of which are intimately interwoven with the walls of the canals which pass through it. To illustrate this I wish to show a drawing from a beautiful recent dissection by Dr. L. A. Calkins of the Minnesota University Medical College. The peritoneum, together with the pelvic viscera, has been removed, in one piece, leaving the fascial and muscular layers through which project the terminations of the rectum, vagina and urethra. This forms a very strong floor covering in the pelvic outlet (Fig. 6).

Hernia appearing in the vagina may find an exit in front of or behind the broad ligament. Those in front descend between the ligament and the bladder and push forward the anterior wall of the vagina, usually to one or the other side. Those behind usually perforate some part of the levator-ani or coccygeus muscles or the interval between them and push the posterior wall of the vagina forward, and as a rule, laterally, and appear in the upper part of the vagina, or, if they come low, in the perineum on either side. Apparently very few go through the pouch in the centre, dissecting the recto-vaginal septum, pushing forward the posterior vaginal wall and appearing in the centre of the perineum, as in the case here presented.

As regards diagnosis, these herniæ have been mistaken for prolapse, for vaginal cyst and for abscess, and several have been operated on under such mistaken diagnosis, the gut being incised and even excised with fatal results. It is therefore well to bear in mind that such hernias do occasionally occur and have to be reckoned with.

As regards treatment it seems to me that operation is clearly indicated, both because of the danger of strangulation, and the interference with the delivery of a possible future child. The form that operation shall take will depend on the individual case. In some operation may be completed with perfect satisfaction from below, as was carried out by Hartman, but there is no question that cases will present in which it will be necessary to open the abdomen to get the best results, or where, as in my case, the exact pathology is uncertain.

## WHY IS END-TO-END INTESTINAL ANASTOMOSIS UNSAFE ?

A CLINICAL AND EXPERIMENTAL STUDY OF TECHNIC, INDICATIONS AND CONTRAINDICATIONS FOR  
END-TO-END ANASTOMOSIS OF THE SMALL INTESTINE AND THE COLON

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THE dangers peculiar to resection and consequent anastomosis of any portion of the intestine are immediate and remote: immediately, that is, soon after the anastomosis has been performed, danger comes from the possibility of leakage into the abdominal cavity of intestinal contents or of purulent material, that might form and collect along the line of union; later the danger comes from the marked or complete stenosis at the point of anastomosis, which would interfere with or obstruct the free passage of the intestinal contents.

The end-to-end method of intestinal anastomosis is certainly the quickest and most physiological method of reuniting the divided gut, and would always be the method of choice but for the fact that it is not as safe as the side-to-side or oblique (author's) methods. It is not as safe as the other two methods, because after the two stumps of the gut have been united by the end-to-end method, the point of anastomosis might undergo a degree of constriction often dangerous, either immediately or after a certain time, and mostly because leakage occurs along the suture line with such frequency as to rightly give the surgeon the impression that the method is unsafe.

The mechanism of the production of stenosis along the line of suture is well understood as being caused by continuous retraction of the cicatricial tissue formed along the suture line as a ring, the circumference of which becomes smaller than the circumference of the gut; if this circumference becomes so small, as to be a serious obstacle to or to prevent the passage of the intestinal content, the stenosis becomes dangerous.

The mechanism by which leakage of intestinal contents occurs along the suture line is not so well understood and it is our purpose to bring forward certain facts and considerations that shall explain why it occurs and to suggest means to prevent it, as far as possible. We shall, however, immediately state that *technically speaking, it is impossible with any method and the most perfect technic imaginable, to perform an end-to-end intestinal anastomosis, either of the small intestine or of the colon, with the positive certainty that leakage will not take place.* The fault is not inherent to any method or to the lack of technical skill of the surgeon, but is inherent to the anatomical conditions in which the anastomosis is made.

## CONSIDERATIONS ON THE ANATOMY OF THE INTESTINE

When the gut is anastomosed by the end-to-end method, when leakage occurs it is almost in every case at the so-called mesenteric angles. These mesenteric angles present a peculiar anatomical condition; the two leaves of the mesentery which surround the intestine leave between them a space irregularly triangular deprived of serosa. It is an axiom in surgery of the abdomen that union between the different parts of the gastro-intestinal tract takes place only when serous surfaces are approximated. Given the condition mentioned above, that the mesenteric angle is not lined with serosa, it was natural to think that this lack of serosa

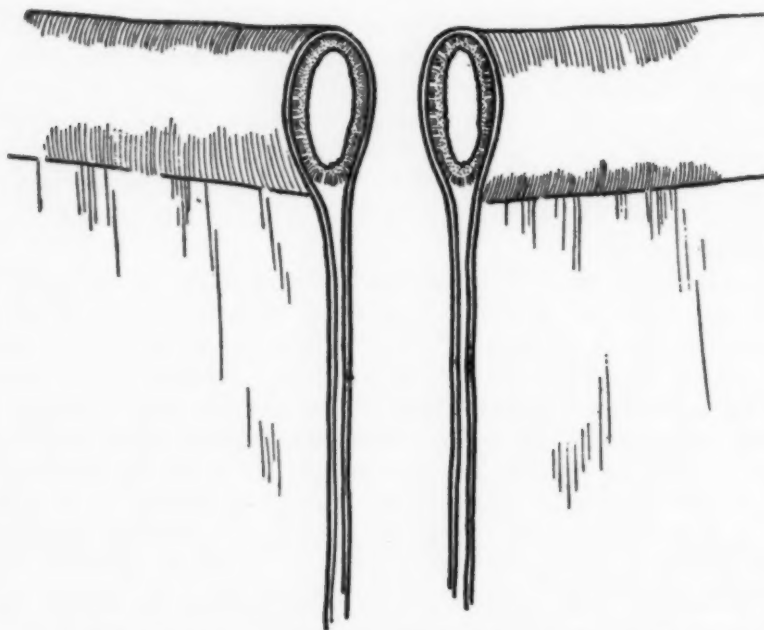


FIG. 1.—Schematic view of end-to-end intestinal anastomosis showing cut edges that have to be approximated and tissues interested.

was the immediate cause of leakage occurring after an end-to-end anastomosis of the intestine. This opinion is so rooted in the minds of surgeons that the triangular space has been called the dead dangerous mesenteric angle. If this view were really correct, it would be a very easy matter to make end-to-end anastomosis of the intestine perfectly safe; in fact, it would be sufficient to occlude entirely the triangular space, by approximating and inverting with a few stitches the two leaves of the mesentery. Instead of being such an easy matter, no method has been devised, and very likely none can be devised, which shall secure the mesenteric angles in such a manner as to make end-to-end anastomosis perfectly safe, as far as leakage from the mesenteric angles is concerned. This is due to the fact that leakage occurs at the mesenteric

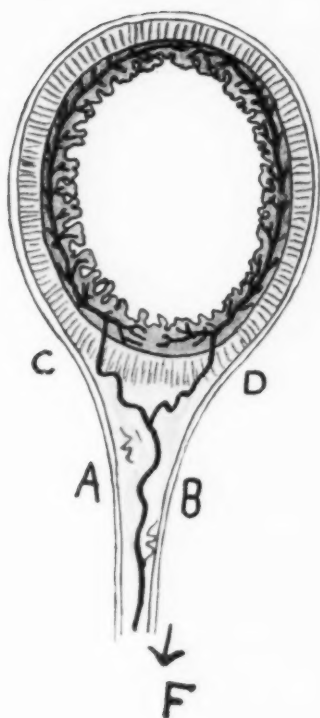


FIG. 2.—Section of intestine showing: *A-B*, the two leaves of the mesentery merging into the walls of the intestine at points *C* and *D*, forming a space that contains loose areolar tissue and the nervovascular system, having as borders: above, the portion of intestine found between points *C* and *D*, which is deprived of serosa, laterally, the two leaves of the mesentery *A* and *B*, below, the attachment of the mesentery to the posterior abdominal wall *F* (mesenteric space).

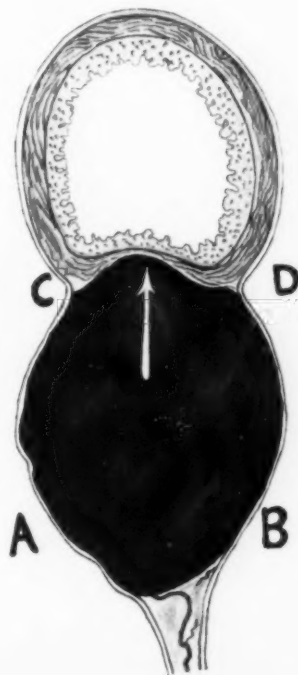


FIG. 5.





1000  
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angles, *not only because of the mere fact that there is a lack of serosa, but for other causes also*, and in order to understand and appreciate these causes, let us briefly examine the status and condition of the two stumps of the intestine as they are when ready to be anastomosed by the end-to-end method.

We have before us two segments of the gut as represented in Fig. 1 which have to be united by surfaces corresponding to their cut edges.

If we examine the cut edges we shall observe (Fig. 2) the following important features:

From below upward the mesentery represented by its two leaves A and B, which are separated from each other; at points C and D the two leaves of the mesentery merge into the intestinal wall forming its outer coat: so that the outer coat of the intestine is the result of the coalescence of the two leaves of the mesentery, and the intestine is surrounded by the two layers of the mesentery, which form its serous coat, except at the space comprised below and between points C and D. The space left between the two leaves of the mesentery is an indispensable and very ingenious arrangement of nature for the passage and protection of the whole nervo-vascular-lymphatic system of the intestine; that is, the mesenteric arteries and the mesenteric veins, the lymphatics and their ganglia, and the nervous plexuses. All these structures are surrounded by loose areolar tissue which contains in its meshes a quantity of fat more or less abundant according to the fatness of the subject. Let us call the attention to the fact that the two leaves of the mesentery do not form in reality a triangular space with the part of the gut that is not surrounded by serosa C-D, because this space is not closed at the bottom (Fig. 2); on the contrary, this space is nothing but a broader space than the space which exists between the two leaves of the mesentery A-B all the way from the root of the mesentery up to its insertion on the intestine, and it is only wider in very thin subjects. In fat subjects a quantity of fat accumulates between the two leaves of the mesentery, increasing the space between them, so that the so-called triangular space is not a triangular space, but only an irregularly shaped space the form of which depends on the amount of fat deposited between the two leaves of the mesentery. So that we can truly state that, below points C and D, there is a space formed by the two leaves of the mesentery; this space has as borders on top the part of the gut comprised between points C and D, laterally the two leaves of the mesentery A and B, below the attachment of the mesentery on the posterior wall of the abdominal cavity. This space contains the blood-vessels, the nerves and the lymphatics of the intestine; is of irregular shape and filled with loose areolar tissue containing fat, and could more correctly be called upper mesenteric space, as we shall do in this paper.

*Anastomosis.*—Let us see now what the surgeon does in performing an end-to-end anastomosis.

He has to resect the gut; make a good hemostasis; reestablish the continuity of the intestinal canal by anastomosing the two stumps of the gut. Let us study thoroughly each of these steps. We beg to be pardoned if we insist on details that appear to be unimportant, but which, on the contrary, must be well understood and fully appreciated, if the whole mechanism of end-to-end anastomosis is to be made clear and plain.

*Division of the Gut.*—The intestine and the mesentery are divided either with scissors, knife, thermocautery; with any of the means employed, the cavity of the gut is laid open and the margins of the wound *will positively be contaminated more or less with the intestinal contents*. We wish to state that no matter how the severing of the intestine is done, how careful is the surgeon, what method is employed, the cut edges of the intestine will always be more or less infected; *an absolute or a complete asepsis or sterilization of the cut edges cannot be obtained*.

*Hæmostasis.*—After resection of the gut and of the mesentery hemorrhage would occur if the blood-vessels supplying the blood to the portion of the gut which is resected were not tied; so the surgeon must secure a good hæmostasis before performing the anastomosis. There are different manners by which hæmostasis can be secured. Whichever method is used the result is exactly the same, that is, it prevents hemorrhage from the cut edges of the blood-vessel passing through the severed mesentery. We have seen that the blood-vessels carrying blood to the intestine pass through the space left between the two leaves of the mesentery; these blood-vessels subdivide themselves as shown in Figs. 2 and 3 at the so-called mesenteric angle and surround the whole gut by an intimate and very intricate anastomosis of all the numerous smaller vessels in which the larger vessels coming from the division of the main ones at the mesenteric angle are subdivided in the submucosa. Hæmostasis, therefore, accomplishes exactly this; it prevents the flowing of blood to the cut edge of the divided vessels, which are located between the two leaves of the severed mesentery; therefore, it leaves the tissues in which these severed blood-vessels are located without any blood supply. As the blood-vessels are tied at a certain distance from the cut edges of the mesentery, it follows that the blood supply of the tissues found between the points where the blood-vessels are tied and at the very cut edges it is nil; they are bloodless.

*Consequences of Hemostasis.*—Let us see what are the consequences of this condition. Admitting that it is impossible, as we shall prove later, to avoid infection or to disinfect properly the cut edges of the divided gut, the loose areolar tissue filled with fat which is below and in immediate contact with the portion of the gut which is not surrounded by serosa (Fig 2, C-D) will positively be infected by being contaminated with the intestinal contents. The loose areolar tissue filled with fat is one of the least, if not the least, resistant tissue to infection and therefore would, even under the most favorable circumstances, always be a

dangerous tissue to have to deal with in performing an intestinal anastomosis. But the poor resistance of the loose areolar tissue and fat to infection is not the only element of danger; the greatest danger comes from the fact that its already little resistance to infection is still greatly decreased by these two factors. This tissue is traumatized either by forceps, thermocautery, ligatures, passing of needles and thread and by too often used and roughly applied sponging. Its blood supply has been absolutely and most completely cut off by tying the blood-vessels which were supplying blood. So that we have as a final condition the following: a tissue which has *per se* little resistance to infection; this resistance is still lessened by trauma and cutting off of blood supply. It would be hard to imagine a more favorable medium for the culture of microorganisms, than the space found between the two leaves of the mesentery: moisture, heat, closed space, and good nutrient medium supplied by the fat which is going to be dissolved; the little or much blood which is always left, even after the most careful hæmostasis, and by the foreign bodies left there, such as catgut; all this with the certainty that the microorganisms will not be disturbed, because the only elements which would be brought in by the blood and could disturb them are kept away by the good and secure hæmostasis made by the surgeon, that does not allow any blood to flow there. And as if one of these mesenteric spaces was not sufficient to hazard the safety of the anastomosis, the surgeon is compelled, in order to perform the end-to-end intestinal anastomosis, to put in the closest contact two of such spaces (Fig. 1), so that the infectious agents found in one will be helped in their work by their neighbors of the other stump. We see then that the danger from end-to-end intestinal anastomosis comes not from the mere fact that the intestine is deprived of serosa at the so-called mesenteric angle, but because the areolar tissue found there is always more or less infected and its already weak resistance to infection is still decreased, or better, rendered absolutely nil, by shutting off its immediate blood supply (Fig. 3). We see, therefore, that the dangers inherent to end-to-end intestinal anastomosis do not depend only on the method employed or on the skill of the surgeon, but depend on anatomical conditions which cannot be changed and that tend to make end-to-end intestinal anastomosis a method of uniting the gut which could be called a method scientifically incorrect.

*Can Unfavorable Anatomical Conditions be Changed?*—But let us suppose that between points C and D (Fig. 2) the intestine was surrounded by serosa or that we could seal the gut at the so-called mesenteric angles: what would happen? If the intestine was surrounded by serosa between points C and D we would have the following conditions when we make an end-to-end intestinal anastomosis: the loose areolar tissue containing fat found at the mesenteric angles would be surrounded, above by the serosa that we have supposed to exist between points C and D, laterally by the two leaves of the mesentery and below by the attach-

ment of the two leaves of the mesentery to the posterior abdominal wall; this areolar tissue, the blood supply of which has been shut off, is *positively infected, and cannot be sterilized*, is traumatized and contains the material used for the ligatures of its blood-vessels and perhaps some stagnant blood: adhesions would form between the serosas forming the two leaves of the mesenteries and the serosas we have supposed to exist between points C and D of both stumps of the intestine; therefore, we would have a cavity formed and closed up by the serosas of the two stumps of the intestine and the attachment of the mesentery to the posterior abdominal wall. What would happen in this closed and securely sealed cavity containing infected loose areolar tissue, fat, material used for the hæmostasis and perhaps some blood? There would be the formation of purulent material, which would keep increasing in quantity, because the loose areolar tissue which is found between the two leaves of the mesentery would be easy prey for the infecting micro-organisms: this purulent material could not be absorbed, because between the two leaves of the mesentery there are no tissues which could do so; therefore, either it would spread between the two leaves of the mesentery or break through somewhere, either into the abdominal cavity or into the lumen of the intestine. The dangers of such a condition have only to be mentioned to make it clear that end-to-end anastomosis would be so dangerous as to be impracticable if the conditions of the intestine were as we have them supposed to be. The only remote hope for the patient's safety would be that the collection of pus would break into the lumen of the intestine before the pus had caused irremediable damage.

*Infection of Mesenteric Angles.*—Some readers might think that our statement that the mesenteric spaces (angles) will positively, absolutely, without any possible exception, be infected while severing the intestine and performing the anastomosis, and that they cannot be sterilized, does not correspond to a mathematical truth: the following experiments will prove our assertion to correspond to mathematical truth.

*We assert most emphatically that purulent, highly infecting material always forms and collects at the mesenteric spaces (angles) when end-to-end intestinal anastomosis has been performed*, because in many hundreds of end-to-end anastomoses performed on animals with every method known, using all possible precautions, severing the gut with the thermocautery, with the sharpest scissors and scalpels sterilized and then dipped in pure carbolic acid, so that the cut edge should be immediately sterilized by the action of the cautery or of the carbolic acid; by beginning the incision from the mesentery up to the mucosa, then cutting the mucosa with thermocautery or carbolized instruments; touching the mucosa with iodine, bichloride, 5 per cent. carbolic acid, formalin, ether, alcohol, and practically with any known other agent thought to have a strong or weak action against microorganisms, we have found *that the space called mesenteric space (angle) was always in every case highly infected from the*

## END-TO-END INTESTINAL ANASTOMOSIS

*very moment the anastomosis had been performed up to eight and, at times, many more days after, and that the use of any of the means mentioned was hampering the union of the resected gut; so that leakage occurred much more often when the thermocautery, carbolic acid or any supposed sterilizing agent was used, than when the gut was simply severed with knife or scissors and properly reunited, as shall be explained later.*

We shall not relate in detail the experiments made, because we think that for the purpose of this paper it is sufficient to mention the results and how they were obtained. We have made hundreds of experiments in the following manner: After the anastomosis had been performed we reopened the abdomen, took up the part of the gut that had been anastomosed and separated with sterile instruments the mesentery close to and a little under its attachment to the intestine, so as to penetrate into the mesenteric space (angle) without, however, entering into the mucosa, collected on a platinum loop a little material, and in every case, up to the eighth day at least, after the anastomosis had been performed, we found that there were microorganisms present.

*Why Does Leakage Not Occur in Every Case of End-to-End Intestinal Anastomosis?*—That leakage does not occur in every case in which end-to-end intestinal anastomosis is performed, does not need any demonstration; we have to explain why it does not always occur. Let us look again at Fig. 2; we see that the two leaves of the mesentery blend so intimately with the intestine at points C and D as to form a whole with the intestine itself, so that it would not be possible to separate the serosa formed by the two leaves of the mesentery from the underlying tissue; the two leaves of the mesentery then continue separated from one another and attach themselves to the posterior abdominal wall. We have, therefore, a space which results formed by line C and D that is made up by that part of the intestine which is not surrounded by serosa, and the two leaves of the mesentery. This space is always infected and in performing the anastomosis is closed up and applied closely to the same space of the other segment of the gut. *In every case of end-to-end intestinal anastomosis there is the formation of a more or less abundant collection of purulent material at the so-called mesenteric angles; what happens to this purulent material? If we examine again Figs. 2, 4, and 6 well we will easily understand why leakage does not occur in every case. We have a closed cavity, the walls of which are formed by the leaves of the mesentery of the two stumps of the gut, the top by the muscularis, submucosa and mucosa of the intestine which is comprised between points C and D, and the bottom by the fat found between the two leaves of the mesentery. That pus breaks through the points of least resistance is an axiom that needs only to be mentioned in order to explain why leakage does not occur in the abdominal cavity. The point of least resistance in an end-to-end anastomosis of the intestine is the union of the parts of the two segments of the intestine comprised between points C and D,*

FIG. 4.

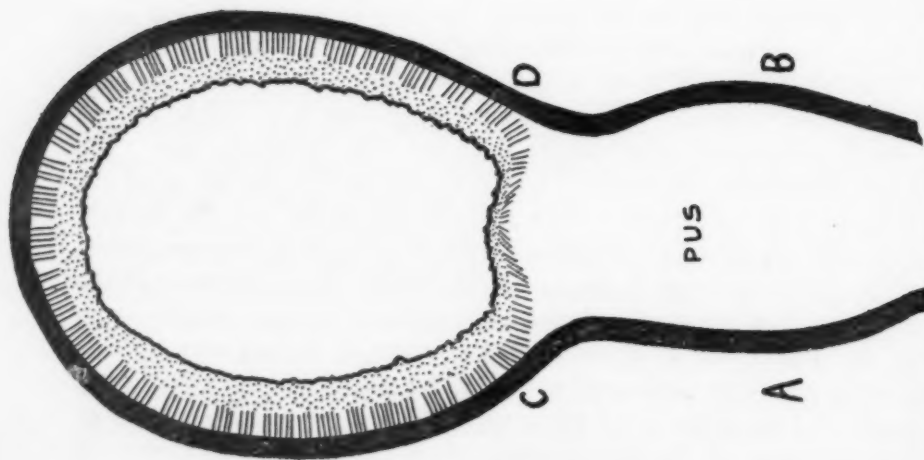


FIG. 5.

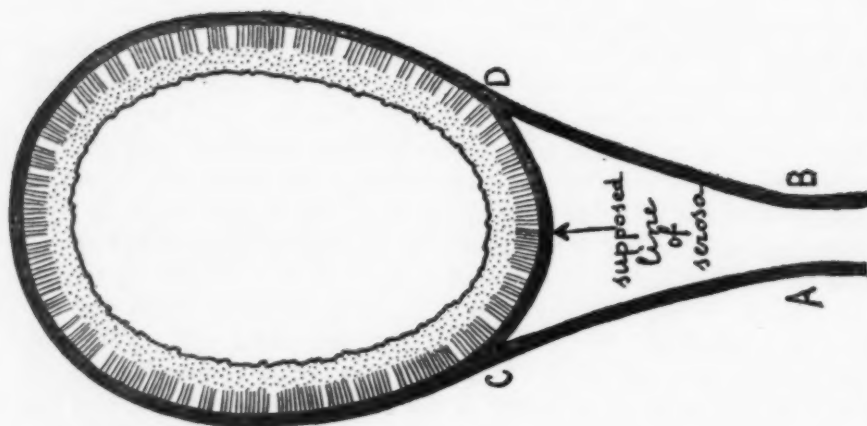
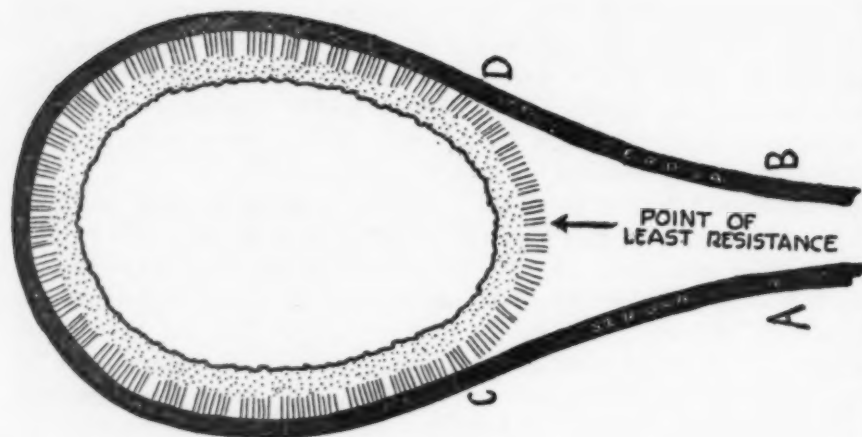


FIG. 7.



FIGS. 4, 5, 6, 7.—The four illustrations 4, 5, 6, 7, show clearly how collections of pus and blood or simple bleeding might become dangerous when met in the mesenteric spaces (mesenteric angles) and how the arrangement of the tissues is providential in preventing danger in most cases. Fig. 4 shows that a collection of pus is formed in the mesenteric space detaching the tissues in which it was formed. Fig. 5 shows the formation of adematoma. Pus or blood will leak through the points of minor resistance which is, shown in Fig. 6, the point found between C and D, because this point is deprived of serosa, and therefore pus or blood will leak into the intestinal cavity. This fact shows the danger that might come from bleeding at the mesenteric spaces; the blood flowing in this space that has been infected will keep on leaking into the intestinal cavity and might cause death from hemorrhage. Fig. 7 shows that if the space comprised between points C and D was lined with serosa or if it could be sealed perfectly, pus would in many cases find its way into the abdominal cavity or down toward the foot of the mesentery, instead of leaking into the intestinal lumen, because the point of minor resistance would not be almost always the point situated between C and D, as it is actually, but might be the union between the two leaves of the mesentery, or the loose areolar tissue found between them.

because, as it is also known to be an axiom in abdominal surgery, in order to have strong and immediate union and adhesion, serous surfaces must be approximated, the union taking place almost immediately, while the muscularis, submucosa and mucosa do never unite immediately, it takes quite many a day before union between them takes place. We can say that the muscularis, submucosa and mucosa unite only and always by secondary intention, because pus forms always between them and they must heal by granulation. Therefore, accepted as proven the fact that the point of least resistance for the pus to break through is the line comprised between points C and D, it is clear that a collection of pus forming in the mesenteric spaces (angles) will break through line C and D and drain into the intestinal cavity or will leak into it while it is being formed. We can, therefore, state that, although in every case in which end-to-end intestinal anastomosis has been performed, there is formation of purulent material at the so-called mesenteric spaces (angles), this purulent material does not cause any apparent trouble, because it drains through the point of least resistance, which is the line of approximation of the muscularis, submucosa and mucosa comprised between points C and D (Fig. 6), and therefore runs into the intestinal cavity: it runs out into the peritoneal cavity only when the two leaves of the mesentery become at any point the *locus minoris resistentiæ*. This occurs when the mesentery is so damaged that its vitality is decreased to such a point that the union between its two leaves is so hampered as to become less firm than the loose union of the muscularis, submucosa and mucosa of the two stumps of the intestine. The lowered vitality and resistance of the mesentery might result from one or more causes, such as union between mesenteries badly damaged by infection or adhesions, traumata, such as clamping with forceps or other crushing instruments, cauterization with the actual cautery, carbolic acid or any other cauterizing agent, tearing the mesentery with large and wide stitch holes, tying knots too snugly, the presence of blood clots or hæmatomata, the presence of ends of thread hanging out and acting as setons, or large knots between the line of union, which knots keep the two leaves of the mesenteries apart at the point where the knots are and do not allow a close and immediate contact between them, etc. Even when the mesentery has been damaged and its resistance greatly diminished, or ends of threads and knots might favor leakage, leakage does only seldom occur, because luckily the mesentery itself forms immediate adhesions with other peritoneal organs, which adhesions are often sufficiently early formed and dense enough to build up a kind of wall stronger than the loose adhesions between the muscularis, submucosa and mucosa of the gut at points C and D. This walling off of the purulent material and intestinal content does not so often occur when the whole intestine has been severely traumatized or infected by a previous leakage of intestinal content into the peritoneal cavity, such as occurs in perforation of the

that might come from bleeding at the mesenteric spaces, is sealed perfectly, or if it could be sealed perfectly, it would not be almost from hemorrhage. Fig. 7 shows that if the space comprised between points C and D was lined with serosa or if it could be sealed perfectly, it would not be almost from hemorrhage. Fig. 7 shows that if the space comprised between points C and D was lined with serosa or if it could be sealed perfectly, it would not be almost from hemorrhage. Fig. 7 shows that if the space comprised between points C and D was lined with serosa or if it could be sealed perfectly, it would not be almost from hemorrhage.

gut, if specially, as mentioned before, large knots are left between the two leaves of the mesentery, so that where the knot is the two leaves do not come into close contact, and even more so when ends of any kind of threads, catgut, silk, linen, Pagenstecher are left hanging out, because then they act as real drains leading into the peritoneal cavity the liquid which forms or collects in the mesenteric spaces (angles).

*Blood Supply of the Mesenteric Angles and of the Cut Edges of the Intestine.*—We have stated that the blood supply of the cut edges of the mesenteric angles is completely shut off and that this lack of blood supply constitutes an element of danger for the union of the tissues forming the mesenteric angles, while the cut edges of the portion of the severed intestine not located in the mesenteric angles are well supplied with blood. As we all know from experimental work made for the purpose of ascertaining the mechanism of union of two segments of gut, that the union is made by the fibrin deposited and organized on and around the cut edges, and that there is a more rapid deposit of fibrin and a more rapid organization of the deposited fibrin the better the blood supply is, we wish the reader to study the blood supply of the cut edges of the intestine after it has been anastomosed by the end-to-end method, as shown clearly in Fig. 3, because this study will make clearer the reasons why leakage occurs more often at the mesenteric angles than at other portions of the anastomosed gut. The illustrations show clearly how the blood is supplied to the gut, after the gut has been resected and properly prepared for the anastomosis. The blood-vessels coming from the mesentery, when they have entered the submucosa of the intestine, anastomose very freely between one another, so as to form a very fine and complicated net of blood-vessels that surround the lumen of the intestine. This free anastomosis of the main blood-vessels coming from the mesentery after they have entered the submucosa and subdivided in many smaller vessels is an arrangement which insures a good blood supply to the intestine, the blood supply of which must be always free and abundant in order to insure the function of the intestine, even if some unfavorable conditions, on which is not the case to insist upon here, should arise. In fact, the blood supply of the intestine is insured even if some of the main vessels coming from the mesentery should be occluded, because the free anastomoses of the finer blood-vessels found in the submucosa insure the blood supply of the portion of the gut, the main blood-vessels of which have been occluded. And this fact is proved by the following interesting experiments: We tied the blood-vessels of a portion of the small intestine close and under the so-called mesenteric angles, so that a portion of the gut of a few centimetres could not have a direct blood supply: this portion of the gut, the blood-vessels of which were tied, did not show any bad effect from the cutting off of its direct blood-vessels; and the reason is very clear if Fig. 3 is carefully examined: blood was supplied to the portion of the gut the direct blood-vessels of which had been tied by

the blood-vessels of the adjoining portions of the intestine on both sides, through the intricate anastomosis of the blood-vessels subdividing in the submucosa. We shall not describe all the experiments made, because they have been undertaken with a purpose which is not directly related to the subject treated in this paper, and they will be published later: we only intend to show that the blood supply of the cut edges of the intestine is excellent, even after the blood-vessels supplying directly blood to them have been tied most accurately. This fact is also proven by the oozing of blood that takes place all along the cut edges of the intestine, after the blood-vessels have been tied at the mesenteric spaces; this oozing from the cut edges has certainly been witnessed by all surgeons, while performing an intestinal anastomosis.

*Why Does Pus Formed in the Mesenteric Spaces (Angles) Not Always Run Through the Two Leaves of the Mesentery Up to Its Root?*—A point that has still to be elucidated is: why does pus so seldom find its way through the space that exists between the two leaves of the mesentery up to their attachment to the posterior abdominal wall (see Figs. 2, 4, and 6); this space, being made up of loose areolar tissue filled with fat, should oppose little resistance to the invasion of the highly infecting purulent material that is found at the mesenteric angles constantly, as it has been stated above. The reason why pus does only seldom reach the posterior abdominal wall through the two leaves of the mesentery, is the same reason given above; pus will break through the structures that offer the least resistance, pus forming in the so-called mesenteric angles, is formed in a cavity having as its walls above the muscularis, submucosa and mucosa comprised between C and D (Fig. 4), on the sides the two leaves of the mesentery and below the loose areolar tissue filled with fat that separates the two leaves of the mesentery. The side walls of this cavity formed by the two leaves of the mesentery are exceedingly resistant and can stand a great deal of distention without breaking or tearing, as is proved by the immense distention they undergo when an hæmatoma (Fig. 5) or a cyst forms between them; their only weak point is the point where the two leaves of one segment of the gut have been united to the two leaves of the other segment; we have seen, however, that union, and a strong and rapid one, takes place when the precautions mentioned above are taken. The bottom is formed by loose areolar tissue and fat, which, not having been disturbed, forms a solid and compact unity well supplied with blood-vessels in normal condition. The top, that is, the union of the muscularis, submucosæ and mucosæ of the two segments of the gut, is the weakest part, because, as we have seen, union between the two segments of the gut at that point does not take place until after a certain time has elapsed, so that the pus leaks through it. Only when, by traumata, cauterization, low blood-vessels ligatures, that is, when the blood-vessels are tied far from the attachment of the mesentery to the gut, on account of the presence of hæma-

tomata, or any other agent, the solidity of the tissues which are found between the two leaves of the mesentery is greatly altered, and its blood supply has been abolished or greatly damaged, and especially when the fat has been or shall become dissolved, does the bottom of the cavity become the point of least resistance, and then, and only then, does pus find its way through the two leaves of the mesentery, and if the latter are also damaged, into the peritoneal cavity.

What has been written above explains why end-to-end anastomosis of the small intestine is always and in every case safer than the anastomosis of the colon. The number and virulence of microorganisms increase from the duodenum, which is often sterile, to the jejunum, to the ileum, to the colon, so that the further down the anastomosis is made the less safe it becomes, because the loose areolar tissue is more severely infected and therefore produces purulent material more abundant and more virulent the nearer we go to the anus.

*Leakage from Other Points Along the Suture Line.*—We have insisted on leakage coming from the mesenteric angles, because leakage from those structures is peculiar to end-to-end anastomosis and not preventable, while leakage from any other points along the suture line is an occurrence common to any suture made on the gastro-intestinal tract and preventable with the employment of a perfect technic, except in the case in which the surgeon is compelled by existing pathological conditions to perform an anastomosis on intestine badly inflamed, infected, or traumatized, or leakage is due to a mistake in dieting, in purging, or to some kind of physical strain. We shall only mention that leakage along the suture line will be due in the great majority of cases to imperfect sutures and to incomplete inversion of the serosas. Imperfect sutures are the ones made with separate stitches, because being impossible to put all the stitches along the same line, if there is any distention of the gut, the stitches which are more taut and are further from the middle line will be put to a more severe strain than the ones that are nearer to the middle line and not so taut, and under the greater strain might probably cut the intestine.

Under the heading of imperfect suture, we must also include: the presence of too many knots along the suture line; stitches that tear the intestine, even in a slight manner; loose sutures which do not approximate closely the serosas, and finally stitches that are too snugly taut, by this we mean those stitches that strangle and cut the tissues: and we have insisted and shall insist on using taut sutures in performing any operation on the gastro-intestinal tract; but by taut sutures we do not mean the sutures that strangle and cut the tissues, but the sutures that approximate closely without tension the tissues that have to be reunited. Other causes of leakage are the great distention which might follow severe traumata or other conditions causing paresis or accidental kinking of the intestine, and in the colon the presence of feces which, as it

might happen in emergency cases, have not been removed before the operation. We do not insist on these points which are familiar to all surgeons doing good surgery; we shall only mention lack of perfect hæmostasis.

*Importance of Hæmostasis.*—Perhaps the greatest element of danger in end-to-end anastomosis of the intestine is the flowing of blood from any blood-vessels situated between the two leaves of the mesentery: therefore, hæmostasis between the two leaves of the mesentery must be absolutely perfect. The danger that might result from imperfect hæmostasis is twofold: either bleeding does not stop and the blood flows into the lumen of the intestine, with even probable loss of so much blood as to cause death, as it has occurred in some of our experimental cases and in one case in a human being, controlled by the writer at the autopsy, or the bleeding stops and an hæmatoma is formed (Fig. 5). When an hæmatoma, even a small one, forms between the two leaves of the mesentery the hæmatoma becomes the most favorable ground for the spreading of infection, because blood-clots are perhaps the most favorable grounds on which microörganisms can grow and multiply, and when the hæmatoma is of large size, it causes a distention of the space situated between the two leaves of the mesentery proportionate to its size, and will compress the blood-vessels carrying the blood to the operated area, therefore limiting its already reduced blood supply and causing a blood stasis, which will naturally favor the growth of microörganisms; will compress the loose areolar tissue; will distend greatly the already thin leaves of the mesentery, therefore weakening their resistance, resistance which might be greatly lessened by the sutures used in approximating the mesenteries of both stumps, by clamping, rough handling and other traumata and by infection. When all or some of these elements contribute in weakening the resistance of the two leaves of the mesentery, the leaves of the mesentery might become the *locus minoris resistentiæ*, and therefore any collection of pus that will form between the leaves of the mesentery, instead of breaking into the lumen of the intestine, as it occurs, as explained before, because the union of the mucosa, submucosa and muscularis at the mesenteric spaces is generally the weakest point of the anastomosis, it breaks into the abdominal cavity and all the possible dangers of such an occurrence need only to be mentioned to be appreciated and feared. We think that we have to insist on the importance of perfect hæmostasis of the leaves of the mesentery of both stumps, because its importance is not appreciated as it should be, and not only the hæmostasis must be perfect, but for the same reasons that hæmostasis must be perfect, so that even the smallest hæmatoma should not form, any blood-clot must be carefully removed. Stagnant blood, either as blood-clots or as hæmatomata, is, perhaps, the most favorable ground to be found in the living body on which microörganisms can grow and multiply very rapidly. In fact, the elements constituting the blood have

a great resistance against infective microorganisms when contained in the blood-vessels and circulating, but when they are out of the blood-vessels and therefore not circulating, they not only lose their resistance, but become the easiest prey to all kinds of microorganisms and supply them the means for their growth, such as humidity and the best nourishing media made up by the liquid and organic matter constituting the blood. We stated that a stagnant blood constitutes perhaps the most favorable ground for the growth and rapid multiplication of microorganisms to be found in the living body, and this statement, on the importance of which we insist, is proven by every-day clinical observations: we see that a large hæmatoma is absorbed very readily and with little reaction if it is kept sterile; if, on the other hand, the hæmatoma becomes infected, the reaction is very marked and a general septicæmia is liable to occur, even when the appropriate surgical means have been resorted to, in order to limit the infected area and proper drainage has been applied; the danger is greater the greater the diffusion of the blood in the tissues. It would seem that the blood elements are like fish: they are full of life and resistance while in the circulating system, as it is with the fish in water; when out of the circulatory system they act as fish out of water, they decay rapidly and become the easy prey of any microorganisms with which they come in contact. We insist on these facts, because, as we have proven above, being absolutely impossible to keep sterile the space situated between the two leaves of the mesentery while performing an end-to-end intestinal anastomosis, stagnant blood will be the most favorable element for production of a large collection of pus, which might break into the abdominal cavity; it is now easily understood why we insist so strongly on the most perfect hæmostasis of the space situated between the two leaves of the mesentery and the removal of any blood-clot from the same.

If even a slight hemorrhage or the presence of any blood-clot, or both, constitute the greatest elements of danger in performing an end-to-end intestinal anastomosis, when met in the space situated between the two leaves of the mesentery, they do not cause any trouble if met in the cut edges of the intestine situated above points C and D (Fig. 2), that is, above the points where the mesentery becomes the outer or serous coat of the intestine. The reasons why hemorrhage and blood-clots are so dangerous when met in the space situated between the two leaves of the mesentery, if well understood and appreciated, will show why hemorrhage and blood-clots are less dangerous when met in the cut edges of the intestine situated above points C and D. Hemorrhage there can be only slight, if hæmostasis has been made properly, because by tying at the mesentery the blood-vessels that supply blood to the cut edges, the cut edges will bleed only very slightly, the blood that oozes out of the cut edges coming from the very free anastomosis of all the blood-vessels of the intestine, as shown in Fig. 3, and demonstrated elsewhere in this

paper. The hemorrhage is always very slight and completely controlled by a good mattress suture as will be explained later. Blood-clots which might eventually form on the cut edges are not dangerous at all because they are brought into the lumen of the intestine by the process of inversion of the serosa which is accomplished in performing the anastomosis, and therefore eliminated, as are the ordinary intestinal contents. The best manner of obtaining hæmostasis will be described together with all the other technical points relating to the performance of end-to-end intestinal anastomosis.

*Practical Conclusions.*—We can immediately draw these important practical conclusions: leakage at the so-called mesenteric angles would not occur if the two external leaves of the mesentery could be reunited in such a manner as to make them adhere immediately and form strong adhesions between them. Therefore, the union of the space found at the so-called mesenteric angles should be accomplished by a means that should approximate, as closely as possible, by inverting them, the external coats of the leaves of the mesentery with the least trauma, and approximate closely but loosely the mucosa, submucosa and muscularis between points C and D (Fig. 2) in such a way as to allow and favor a firm and rapid union between the external coats of the mesentery, that should force any collection of purulent material through the space situated between C and D into the lumen of the intestine; this is accomplished perfectly satisfactorily with the stitch shown in Fig. 13 and paying great attention to all the details of technic which will be described later.

What would happen if the intestine was all surrounded by serosa would also happen if we could seal completely and securely the gut at the upper mesenteric spaces (angles) with serosa. Admitting, therefore, that the upper mesenteric spaces (angles) are infected in every case of end-to-end intestinal anastomosis, we feel justified in having asserted that no technic has been devised, and none will very likely be ever devised, that will make end-to-end intestinal anastomosis really safe in regard to leakage from the upper mesenteric spaces (angles), and we feel justified in making the following statement: End-to-end anastomosis of the intestine would be so unsafe as to have to be considered almost a surgical impossibility if the mesenteric space (angle), which is absolutely indispensable for the passage and protection of the nervo-vascular system, was not deprived of serosa as it is (Fig. 7), and, if possible, such spaces were completely sealed with serosa by the surgeon, and that the lack of serosa around the intestine, at the so-called mesenteric angles, is a providential arrangement, which allows the performance of end-to-end intestinal anastomosis, instead of being, as it is thought to be, almost a mishap of nature, or, at least, a great obstacle, making end-to-end anastomosis of the intestine difficult and unsafe; the lack of serosa is to be considered as a safety valve that prevents pus from burst-

ing into the abdominal cavity. We can see that the danger that is inherent to end-to-end anastomosis of the intestine is due to the special condition of the tissues forming the mesenteric spaces (angles), because they are filled with tissues that have *per se* little resistance to infection, which resistance is rendered still weaker by the fact that the blood supply of these tissues is completely cut off. So the reason why leakage occurs at the mesenteric spaces (angles) is not because there is lack of serosa around the intestine at those points, but because the mesenteric spaces (angles) are filled with tissues which are positively infected, the infection of which cannot be avoided, and which have little resistance against the infecting microorganisms, this resistance being rendered still weaker by the shutting off of its blood supply.

These conditions are not present in the other portion of the gut, the union of which is greatly favored by the possible complete inversion of the serosas and the excellent blood supply of their cut edges, as we have demonstrated.

We shall now bring forward the points which will help to make end-to-end anastomosis of the intestine as safe as it is possible to make it, and avoid whatever might endanger its safety. We shall describe each single step that will make up what we consider, on the basis of experimental and clinical experience, a perfect technic of end-to-end intestinal anastomosis.

*Resection of Gut and Mesentery.*—After the surgeon has decided what portion of the gut he intends to resect, clamp with long forceps the portion of the gut and mesentery that has to be removed, placing the forceps at about half a centimetre from the intended line of incision; gently milk back the possible intestinal contents and place a light clamp, or, still better, pass through the mesentery, without tearing any blood-vessels, a light rubber band, or rubber tube and tie it over the portion of the intestine that is going to remain at about five centimetres from the intended line of incision (Fig. 8). Starting from its root, then sever the mesentery up to its attachment to the intestine, opening completely the mesenteric space (angle), but not entering the lumen of the gut. The bleeding vessels are clamped, beginning with the blood-vessels further away from the intestine; that is, the blood-vessels that will be clamped first are the blood-vessels coming from the root of the mesentery. Clamp only the bleeding vessels, without including any other tissue; this will be easily accomplished with a little attention, because the blood-vessels emerge from the loose areolar tissue and fat found between the two leaves of the mesentery (Fig. 9). Proceed then to clamp any blood-vessel that bleeds up to the mesenteric angle. Each blood-vessel that has been clamped must be tied accurately without undue pulling; the tying can be made either with silk or catgut, according to the preference of the surgeon, provided that the catgut or the silk be the finest; plain catgut No. 000 is, according to our experiments, the best material for tying the blood-vessels of the mesentery; the ends of the thread must

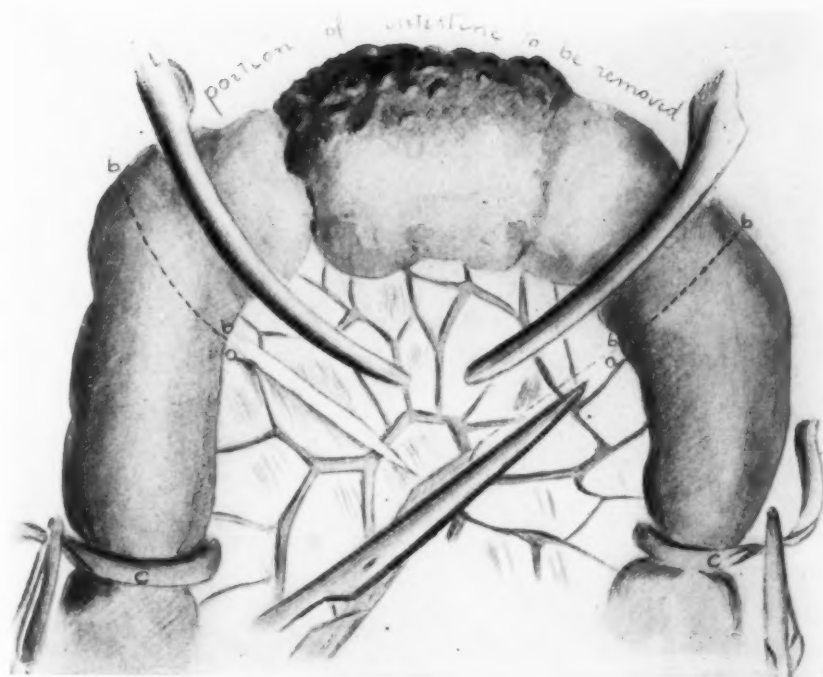


FIG. 8.—Forceps applied to portion of gut that is to be removed about half a centimetre from the intended line of incision, *b-b*, and rubber bands *c-c*, applied at about 5 cm. from intended line of incision. The mesentery is cut *a-a*, up to its attachment to the intestine, without entering the lumen of the same.



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be left very short. Abandon for the moment this portion of the gut and do exactly the same with the gut and mesentery at the other side of the part of the gut that has to be removed. The assistant with the thumb and index finger of one hand gently squeezes the portion of the intestine that is to remain close to the line of incision, and with the other hand takes hold of the forceps that have been put on the gut and mesentery (Fig. 10). The surgeon passes a pair of sharp scissors between the gap made in the mesentery and with one single stroke cuts the intestine. The assistant separates immediately the cut portions of the intestine; the surgeon covers the one to be removed with a piece of gauze, which can be kept in place by a Museux forceps and abandons it for the moment

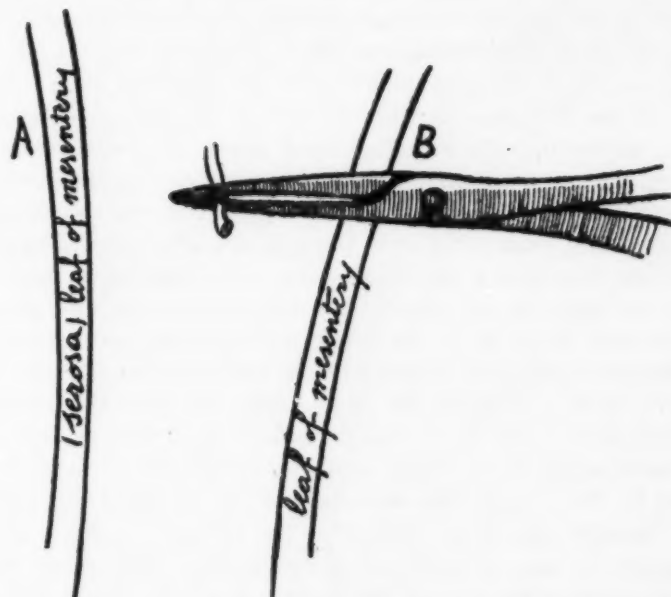


FIG. 9.—Correct manner of clamping and then tying the blood-vessels found between the two leaves of the mesentery, A and B. The blood-vessels have to be clamped and tied without including any other tissue but the blood-vessels.

(Fig. 11). With two thumb forceps he then grasps the cut edges of the other portion of the intestine, so as to keep its lumen open and looking toward the ceiling, the assistant takes off his fingers and with small sponges held on forceps or small sponge holders gently cleans the cul-de-sac formed by the rubber band or the forceps that were put on the gut; he must be careful not to touch the cut edges with the sponges, so as not to unduly infect them; for this reason the sponges must be very small (Fig. 12). When the cul-de-sac has been cleaned, so that nothing leaks out of it, a dry pad made of several layers of gauze is put on the abdomen and the gut is laid on it; another gauze pad is put over the intestine, so that it rests between two gauze pads, and it is abandoned for the moment.

The other portion of the gut is then taken up and severed with the same manœuvre employed before. The portion of intestine that has to be removed is taken away, severing its attachment to the root of the mesentery, catching and then tying the blood-vessels that might bleed.

*The Making of the Anastomosis.*—The surgeon begins the suture of the stumps of the intestine at the upper mesenteric spaces (angles); he uses a strand of catgut No. 0, preferably of dark color, threaded on two needles. The choice of the needles is to be left to each surgeon, the ones who are accustomed to work with the needle holder, can use curved needles with the advantage of keeping their fingers clean; we use straight plain mending needles, covering our right thumb and index fingers with thin rubber finger cots, which are thrown away after the anastomosis is made. The upper mesenteric spaces (angles) are closed ideally with the stitch that we shall call mesenteric stitch, shown in Fig. 13. It is begun by passing one of the needles from within the lumen of either of the two segments of the intestine through the whole thickness of the gut and mesentery, traversing the so-called dead space, at a distance of about 3 mm. from the cut edge, avoiding, of course, any blood-vessels. Then the needle is introduced into the other segment of the intestine, on the same side, passing from without in through the mesentery and intestinal wall, naturally traversing the dead space. The needle is then brought out again through the intestinal wall and mesentery, and going back toward the other segment of the intestine is passed through the mesentery and the intestinal wall, coming out in the inside of the intestine at a distance of a few mm. from the spot where the mesenteric stitch was begun. The needles are then brought out of the lumen of the intestine, close to the attachment of the mesentery, so that the threads cross each other, that is, the needle that has been used to make the mesenteric stitch *a* is brought out of the lumen of the intestine a little above the point *i* where the same needle went through the thickness of the intestine and mesentery at the start of the mesenteric stitch. The other needle *b* is brought out on the other side of the same segment of the intestine, also a little above the point where the thread has entered the gut. The illustrations show better and more clearly than any description the very easy manner of closing the mesenteric spaces (angles) with the mesenteric stitch described above. The two stumps of the intestine are then approximated, and the threads are pulled tightly and parallelly to the line of suture; that is, the fingers pulling on them must not be raised above the plane on which is the intestine. We beg to call the attention of the reader to the fact that the dead spaces have been traversed four times and that the pulling on the threads closes up completely the mesenteric angles and keeps them closed without putting in any knot. We shall see later the importance of these details. The suture is continued all around the lumen of the gut in this manner (Fig. 13). Either one of the needles enters the serosa of the stump of the other segment of intestine, that is, not of the

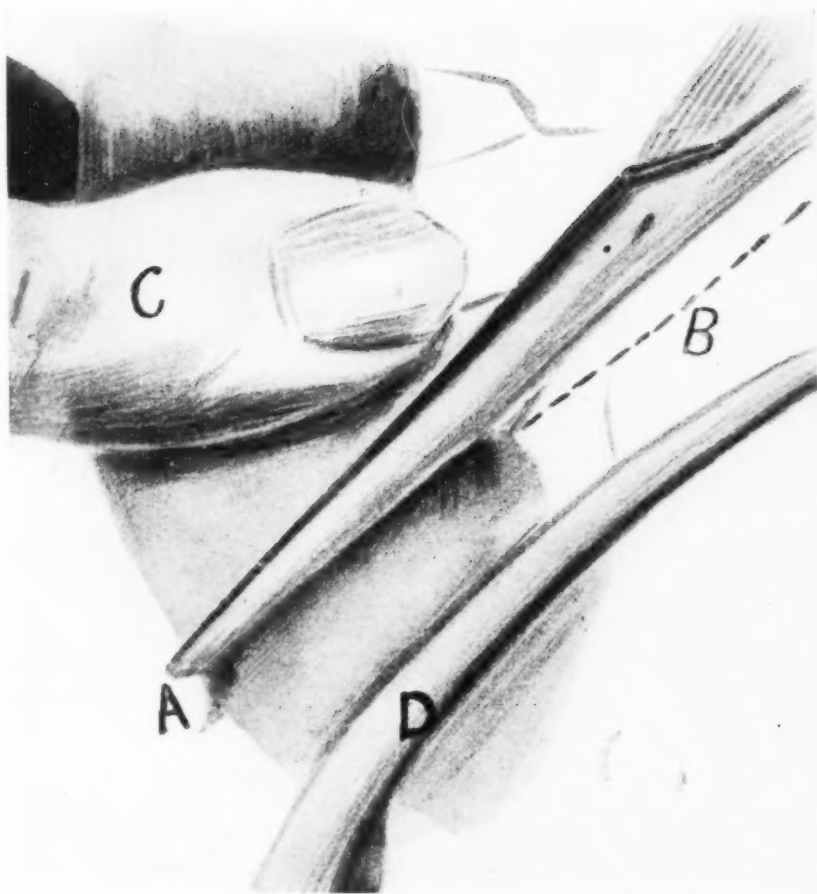


FIG. 10.—The surgeon passes the scissors in the opening already made into the mesentery *B*, while the assistant squeezes between his index and thumb *C* the intestine with one hand and with other takes hold of forceps *D*, and with a single stroke cuts the intestine.



FIG. 11.—Separation of the cut portions of the gut; a piece of gauze covers the cut edge of the portion to be removed, A, and is held in place with a Muzaux forceps.

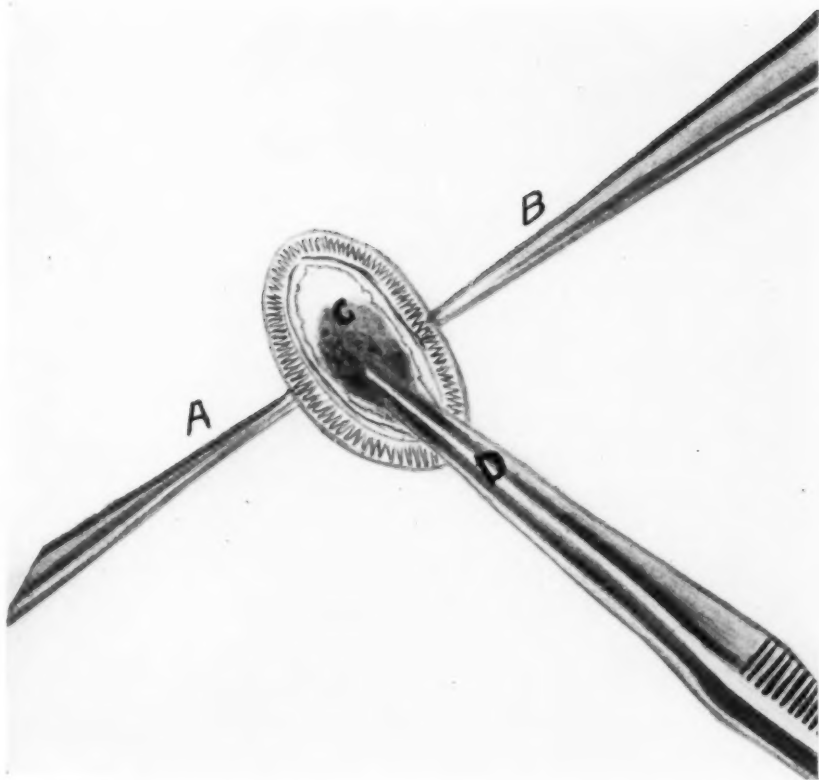


FIG. 12.—Cut edges of gut grasped by surgeon with two thumb forceps while assistant with small sponges, *C*, held on a sponge-holder forceps, *D*, cleans lumen of intestine.

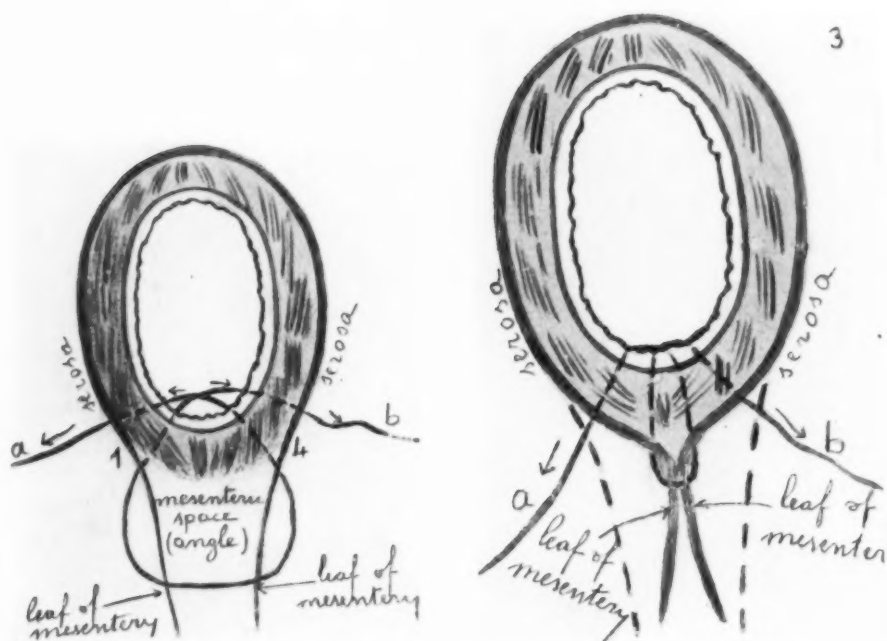
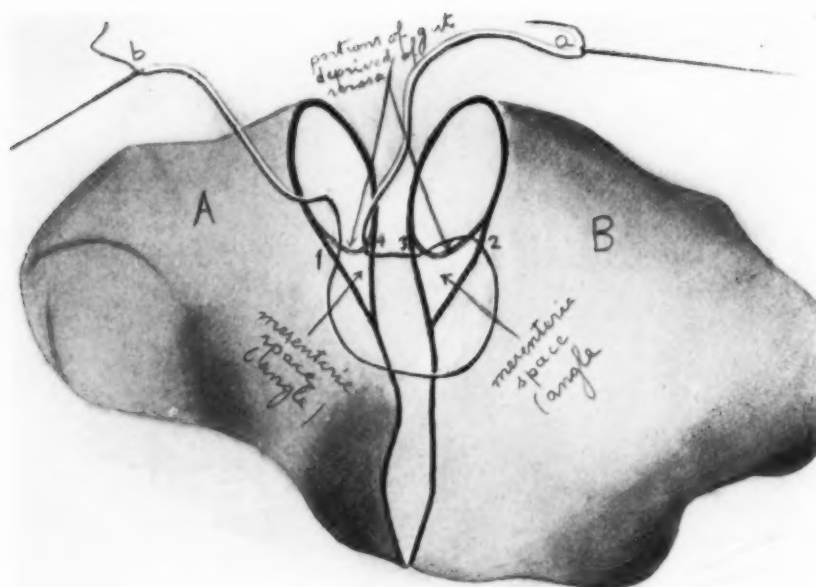


FIG. 13.—Mesenteric stitch. The illustrations show the three steps in which is divided the making and closing of the mesenteric stitch. The first step is made entirely with needle *a*, which starts at point 1 entering the lumen of the gut and coming out on the mesentery, traversing the acute angle made by the mesentery and the portion of the gut deprived of serosa. The same needle *A* then traverses the corresponding acute angle of stump *B* at 2, perforating first the mesentery and then entering the lumen, then it traverses angle 3 perforating first the lumen and then the mesentery, finally it traverses angle 4 perforating first the mesentery and then entering the lumen. The second step consists in making needles *a* and *b* traverse the gut from the inside to the outside a little above of points of entrance of mesenteric stitch, needle *a* coming out above point 1 and needle *b* coming out above point 4. The third step consists in closing the mesenteric space without the use of knots, this is accomplished by pulling threads carried on needles *a* and *b*; dotted line shows former position of the two leaves of the mesentery before threads were pulled, that is, position identical with the position in serosa; note how serosa is well approximated at the mesenteric space, and mesenteric space is closed without undue tension, after threads have been pulled taut.

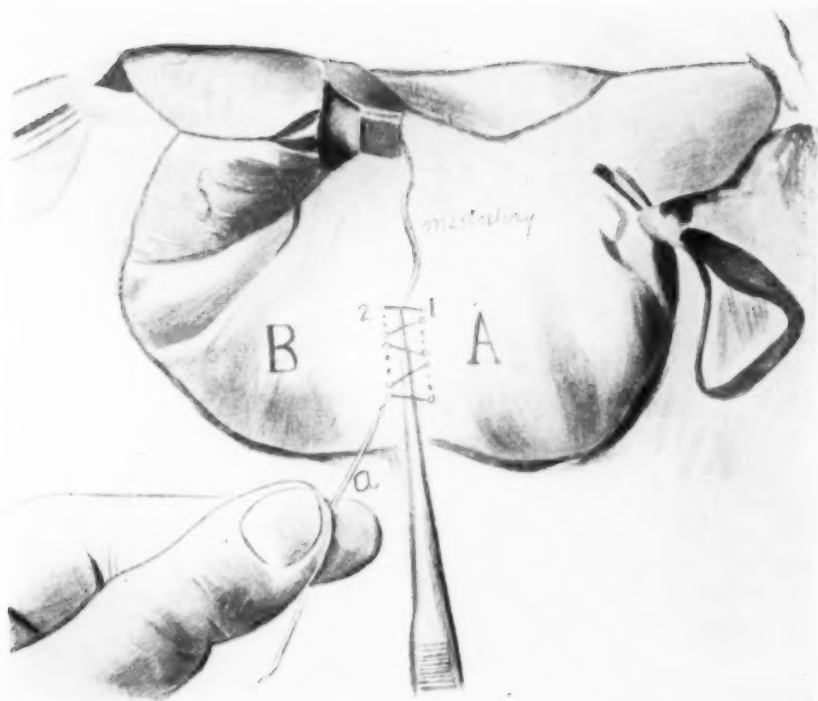


FIG. 14.—Needle *a* that in the preceding illustration after having completed the mesenteric stitch comes out at point 1 on stump *A*, perforates stump *B* at point 2 and closes portion of the gut by means of the special mattress stitch shown in illustration. The thumb forceps shows how inversion of the serosa can be obtained in a perfect manner by pushing inward the cut edges while the thread is pulled taut. The other portion of the gut is closed with needle *b* as explained in the paper, dotted line shows course of needle through the thickness of the gut.



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same stump on which it is left after the completion of the mesenteric stitch, but on the other stump; it penetrates the serosa at about three or four mm. from the cut edge, goes deeply so as to be sure to catch the muscularis and the submucosa (Fig. 14), and takes a bite parallel to the cut edge of the intestine of about three mm. It comes out on the serosa and takes a similar stitch on the other segment of the gut entering the serosa close to the point of exit of the mesenteric stitch, and several stitches are taken in the same manner, going from one segment to the other. Each stitch is pulled taut, so as to invert the serosa, which inversion takes place naturally, if the stitches are put parallelly to the cut edges and are taken close to each other; in case the inversion should not take place spontaneously only by pulling the thread, it can be helped by putting a thin forceps under the thread and pulling the thread while the forceps make a gentle pressure on the cut edges of the intestine (Fig. 14). When about half the suture has been made, the needle is dropped and the other needle is taken up and the stitching is continued on the other half of the intestine, exactly in the same manner as the first half. The two ends of the thread should then come out near the top of the intestine, one opposite the other, are knotted, seeing that the knot falls between the line of suture, so as to be buried between the inverted serosa; in order to bury completely the thread under the serosa the ends of the thread should be cut rather short close to the knot. In order to perform a rapid intestinal anastomosis of the intestine by the end-to-end method, that will be easy to make and as safe as it is possible to render safe end-to-end intestinal anastomosis, we recommend still warmly the technic that we described in *Surgery, Gynecology and Obstetrics*, July, 1912. Here we give the technical elements that will make end-to-end intestinal anastomosis a procedure as rapid and as safe as it is possible to make it; elements which are absolutely essential and have been found so in several thousand intestinal anastomoses made with all methods and with the greatest attention to each single detail.

The mesenteries of the two stumps of the intestine are then sewn together in the following rapid manner. The finest black catgut or silk obtainable is used, and beginning from below, that is, from the root of the mesentery, a stitch is put between the two mesenteries and tied, then the needle goes from the mesentery of one segment to the mesentery of the other, taking a bite of about three or four mm. parallel to the cut edge at about three mm. from the same, and proceeds up to the attachment of the mesenteries to the intestine, pulling each stitch and obtaining in this manner an inversion of the cut edges of the mesentery, and burying of any thread that should appear; when the attachment of the mesentery with the intestine is reached the thread is tied and its ends cut short. The same thing is done on the other side of the mesentery. Care must be taken to get through only the most superficial layer of the mesentery with the needle and thread. A still better manner of closing

the mesenteries is illustrated in Fig. 15. It is a shoe-lace suture made with two needles, clearly explained in the illustrations.

*Advantages of Technic Described.*—Clamping the gut and mesentery that has to be removed is the quickest and safest manner of preventing leakage and bleeding; clamping it at about half a centimetre from the line of incision does not cause any trauma or other injury to the portion of



FIG. 15.—Shoe-lace stitch that will close and invert rapidly the two leaves of the mesentery.

the intestine that is going to be left. Milking back the intestinal contents will prevent leakage of the same, when the intestine is severed; rubber tubing or rubber bands have the advantages over clamps that they are not cumbersome and do not traumatize the gut, as it is done by even the best clamps. We put the rubber tubing at about five centimetres from the intended line of incision and not further, because it is easy to milk and then clean five centimetres of gut, while it would be more difficult to milk and clean a longer segment, and five centimetres give sufficient room for

a rapid accomplishment of the anastomosis. Opening the mesentery from below upward prevents avoidable infection of the same, especially when it is done with the same instrument that is used to open the intestine. The bleeding vessels are caught, beginning with the ones that come from the root, because as long as the blood-vessels come from the root of the mesentery, it is more logical to tie first the main ones, and, only if necessary, tie also the branches which might not bleed when the main vessels are tied, and therefore have the advantage of saving some time by not doing unnecessary ligatures and leaving less foreign bodies. We recommend to catch only the bleeding vessels, which is easily done if the surgeon is attentive and careful, because including in the clamps, and after in the ligature, other tissue is not only unnecessary, but will favor sloughing of these tissues, which sloughing will favor the formation of abscesses, as infection always occurs, and given the little resistance and vitality of the tissues found between the two leaves of the mesentery, as explained elsewhere. We recommend the finest thread, because it is obvious that, at least, it is useless to employ heavy thread where a fine one will suffice, and catgut No. 000 is recommended because strong enough and easily absorbed. The ends of the thread must be cut very short, because they should not hang out of the line of suture, with the probability of forming a kind of seton that would carry infectious material in the general peritoneal cavity.

The technic of severing the intestine, as we have described, insures in the best manner cleanliness and rapidity; no infectious material is spread anywhere; the only element necessary for a rapid and clean work is the intelligent coöperation between surgeon and assistant.

We recommend for the end-to-end intestinal anastomosis only one row of sutures; many thousand intestinal anastomoses made for experimental purpose and clinical experience have proven to the complete satisfaction of all who have witnessed our work that one single row of sutures is sufficient to insure a good anastomosis; we do not insist here on the advantages of the technic described by us in the paper already mentioned, that technic was proven always satisfactory, because safe and most rapid, even more rapid in the hands of men trained in its use, than the anastomosis made with the Murphy button. As we have explained the advantages of the method in the paper already referred to, we beg the reader to read it again if more details are desired. Here we shall only insist on what we consider the essential elements for a rapid and safe end-to-end intestinal anastomosis. One row of sutures is recommended because the union which takes place between the serous surfaces takes place independently of any suture; as long as the serous surfaces are approximated closely and lightly irritated, they adhere immediately, the adhesion becoming stronger, not on account of any suture material which has been put in, but by the organization of the fibrin deposited on the line of union. And, in fact, Murphy used his button

without putting any re-enforcing serous suture and obtained firm and strong unions, although the tissues engaged in the button and tightly approximated do slough away very rapidly. With one row of suture, as advised above, we approximate closely the serous surfaces (Fig. 16), which being irritated by the trauma of passing the needle and thread and the consequent light infection, react and in reacting produce an irritation of the serous surfaces resulting in a localized adhesive inflammation of the serosa, inflammation which will be localized only along the suture line (Fig. 16 a), if the technic advised above is followed carefully, in this way avoiding the formation of undesirable adhesions.

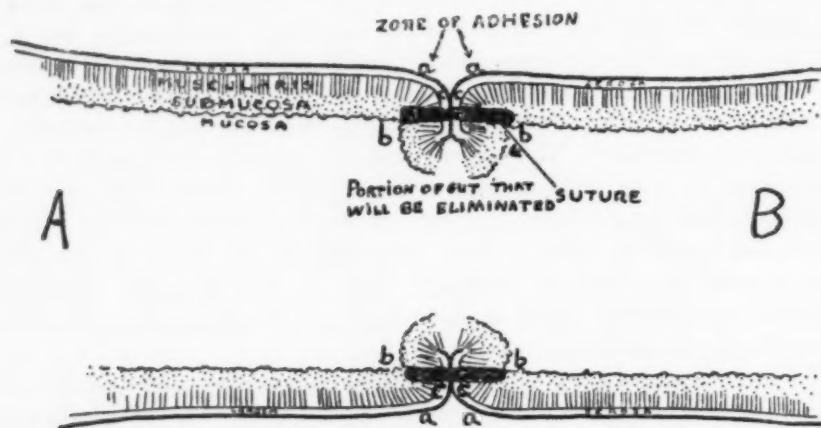


FIG. 16.—Schematic view of how one row of mattress suture inverts and approximates the serosa of two stumps of intestine A and B anastomosed by the end-to-end method, and of mechanism of union between the inverted serosas. If the suture is kept taut after having inverted the serosa we see the following features: the suture has traversed the cut edge of the intestine and therefore infected the serosa at points *cc*, at which points the serosas of both stumps A and B come in close contact; the suture being taut will deprive of blood supply the portion of the cut edges which is below the suture itself, in the illustration this is marked by *b* and *b*, and this portion of the cut edges will slough off and fall in the lumen of the intestine; the hold of the suture on the tissues being limited to the time that it takes for the tissues below points *b* *b*, to lose their vitality and slough off. Above points *cc* the serosa of the two stumps of intestine is brought in close contact, is irritated and infected by the passing of the needle and thread and will set up a localized area of inflammation, so that fibrin will be deposited in the hollow formed by the inversion of the serosa *aa*, which fibrin will seal up the line of anastomosis when the suture, on account of the sloughing of the tissues below points *b* *b*, gives way. The final zone of strong adhesions formed between the two stumps of the intestine when the fibrin is organized will be limited to points *aa*, and *cc*, and will not narrow to any considerable extent the lumen of the gut.

*Mechanism of Union Between Serous Surfaces.*—We beg to be allowed to insist on the mechanism of union between serous surfaces, because it seems to us that it is generally not well understood. Union between serous surfaces takes place always and only through an intimate process of reaction of the serous surfaces that come in contact; when any serous surface is irritated by any cause, trauma, infection or whatever it might be, it reacts more or less violently according to these two principles: it reacts more violently the more serious and violent the irritating element; it reacts more violently the more vital the irritated peritoneal surface is. If we apply these principles to the mechanism of union between two stumps of intestine reunited by the end-to-end method, we shall easily see that the technic we have advised will make end-to-end anastomosis

of the intestine as safe as it is possible to make it. We have to approximate closely the serous surfaces, we have to preserve as much as possible the vitality of the intestine especially along the suture line. With one row of sutures as advised by us, do we approximate very closely the serous surfaces? By taking the stitches parallelly to the cut edges and very close to each other at about three mm. from the cut edge and pulling the thread very taut, we obtain an inversion of three mm. (Fig. 16) of the serous surface of each stump of the intestine and a most intimate and close approximation of the serous surfaces reunited by the stitches, which being put close to each other and parallelly to the cut edges (Fig. 14) reunite, when the thread is pulled taut, the serous surfaces so intimately and closely along the suture line that they appear to be glued together (Fig. 16). The irritation caused by the passing of the needle and thread will set up a reaction from *cc* to *aa* (Fig. 16), and if the stitches are close to each other, the points of reaction will be so close to each other as to merge one into the other, making a continuous line of reaction all along the suture line. Not to be neglected, although it is wrongly feared by the surgeon, is the element of infection in setting up a very helpful reaction all along the suture line. We have recommended to take the stitches very deep, so as to be sure to take in the muscularis and the submucosa; we add that the surgeon has not to fear to enter the lumen of the intestine, because the infection carried with the thread is not only not dangerous but will also help in making the anastomosis safer, instead of being an element of danger, as it is wrongly thought, provided certain conditions, that we shall mention, are not neglected. In fact, if the thread enters the lumen it will be infected; at each point of emergency of the thread on the serous surfaces there will then be a point of strong reaction, *cc* (Fig. 16), because the serosa has been irritated by the passing of the needle and thread and the infection carried by them, if these points of reaction are close to each other and the thread is taut we shall have a continuous line of serosa which reacts rather strongly and will therefore set up a localized inflammation of the serosa which will seal up completely with a deposit of fibrin the line of union of the two stumps of the intestine that have been anastomosed; when the fibrin from *aa* to *cc* (Fig. 16) is organized we shall have a strong union between the two stumps of the intestine that will insure the gut against any leakage. Naturally the stitches must be taken parallelly and close to each other and to the cut edges and kept taut in order to obtain a continuous line of reacting serosa, which shall form a smooth, even, continuous line of union later. And we feel that we must insist on another very important point in regard to union between serous surfaces; in the first three days after the anastomosis is made leakage of intestinal contents cannot take place if the suture has been properly performed, *because the suture properly placed does prevent any leakage on account of the close approximation of the cut edges*; if leakage occurs in the first three days,

the fault might be all with the surgeon, because he has either sewn up portions of intestine so badly damaged that they did not hold the suture, or he has not put in a good suture, more often and mostly because the stitches were either too loose or too taut, and this will occur specially when the intestine is sutured with separate stitches, or the general condition of the intestine made suturing of the same very precarious. To prove this assertion any surgeon has to perform an intestinal anastomosis or a gastro-enterostomy on a dog and then, closing on one end, either the stomach or the intestine, tie the other end on a large syringe or on the water faucet and allow the water to fill them and have them rather distended by the pressure of the water inside the lumen; if water leaks through the suture, or the line of suture breaks at some points, it means that the suture was not well made and leakage or breaking will occur specially when separate stitches have been used or the serosa and muscularis has been badly damaged by pulling the thread in directions not parallel, as we advised, but against the tissues that have been sewn up, just as a wire or a thread is pulled against the cheese in order to cut it. If a continuous mattress suture with close stitches, as we have recommended, has been used and the stitches have been kept taut, no leakage whatsoever will occur and would therefore not occur in a stomach or in an intestine sewn up in the same manner, after a real surgical operation had been performed on them, for about three days. After three days the tissues included in the suture (Fig. 16) begin to slough off *bb*, and, therefore, the hold that the suture has on the tissues is getting weaker every day, until after the fifth or sixth day it is absolutely nil and therefore the union is as strong as the fibrin deposited on the line of union between *aa* and *cc* (Fig. 16) makes it; therefore, the more fibrin there is, the stronger and safer will be the union and the more fibrin there will be the better is the blood supply and healthier the tissues reunited. It follows, then, that any anastomosis made between the stomach or the intestine will be, when properly executed, strongest the first day after it is made, become weaker up to the fifth or sixth day, at which time it will be weakest, and then gradually get stronger, until after fifteen or twenty days it is really very strong. It follows, therefore, also, that the idea of purging or feeding patients only after five or six days, that the stomach or intestine has been sewn up, is absolutely wrong, because then the surgeon puts a great strain on the line of union at the very time that this union is weaker. Our practice is to feed patients operated on the gastro-intestinal tract as soon as possible after the operation; we give them twice a day paraffin oil in order to lubricate the bowels continuously, and we do not allow them to have their bowels move violently for at least two weeks; their stools are facilitated only with oil enemata, and are allowed only in the recumbent position on a bed-pan while in bed; these precautions are naturally more important when the colon has been sutured. It follows, also, that the anastomosis has always to be per-

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formed on gut the circulation and vitality of which are absolutely good; otherwise the failures should not be thought to be due to the special method followed in performing the anastomosis, but only on the poor judgment of the surgeon, who has not selected the proper portion of the gut, that is, he has either selected a portion of the gut the circulation or the vitality of which was poor, or unfortunately has to deal with a patient whose peritoneum could not react properly, as it happens when a general peritonitis is present and the surgeon is compelled to perform a resection and successive anastomosis of the stomach or of the gut; in these cases we would advise, when time is not the most important consideration, not to resort to end-to-end anastomosis of the intestine, but to the side-to-side, or better, to the oblique anastomosis. From what we have stated above, we can also see how important it is to preserve as much as possible a good blood supply to the stumps of the intestine that have to be anastomosed. We believe that the blood supply is preserved, as well as it is possible to preserve it, if the technic that we have advised is followed, because only the vessels that do actually bleed are tied so that the blood-vessels can carry a very rich blood supply to the stumps of the intestine up to their very edges, as shown in Fig. 3.

We select catgut No. 0 because it is absorbable material and as we have proved in another paper,<sup>1</sup> it is not safe to use unabsorbable material on the stomach or on the intestine, when the suturing material enters the lumen, because it might not be eliminated and might become the centre of ulcers or of calculi (Fig. 17), which can even completely obstruct the lumen of the intestine. In the technic recommended by us, where the suture is done over the special rubber tube, we recommend silk because it is always eliminated with the tube, but when that technic is not followed, catgut must always be employed for any suture that might enter the lumen. Catgut No. 0 is recommended for any intestinal anastomosis, because it is fine, therefore does not tear large holes in the serosa which might cause adhesions with other peritoneal organs, and being sufficiently strong for any intestinal suture and lasting at least from ten to fifteen days, will positively hold the stump of the intestine together until strong adhesions have formed. We recommend catgut of dark color, because it shows clearly if the suture is well performed. We stated that no suturing material should be seen when the stitches are properly placed and are kept properly taut, so that they approximate closely and securely the serosas; it is easy to understand that suturing material of dark color will show itself much more plainly than the ordinary plain catgut, which is of about the same color as the tissues that have been sutured and gets confused with them; therefore, it is more probable that a suture might result to be loose when suturing material of neutral color is used than when suturing material of dark color is employed. And we insist on

<sup>1</sup> Soresi: *ANNALS OF SURGERY*. Secondary Ulcers of the Stomach and Intestine, March, 1915.

recommending that any suture made on a peritoneal organ should always and in every case be very taut; the suture has to approximate very closely serous surfaces, so that they shall adhere between themselves; the closer the union the more rapidly will adhesions form. The stitch that will approximate best the serous surfaces is the mattress stitch that we have described, because the line of union is made with one single thread, that when taut will form almost a straight line parallel to the line of union, in this manner holding the surfaces that have been sewn up closely approximated and without any tension, because the tension is distributed and balanced all along the suture line. But we must insist on a most essential point, that is, on always keeping the suture taut, and this is best and most easily accomplished by using thread of dark color, which will show itself very plainly between the surfaces that have been sewn together if the suture is not taut. We recommend the special mattress stitch that we have described because if accurately made it is not only the most rapid manner of suturing the serosa, but it is the safest; it does approximate the serosas so perfectly that they seem glued together (Fig. 16). The special stitch, that closes the mesenteric angle, we believe to be the best method of closing it; in fact, it closes completely the dead spaces and then holds them closely together without any undue tension; the serous surfaces are closely approximated, but there is no tension anywhere and the dead spaces are closed but not too tightly, so that any purulent material that should form in the mesenteric angles can leak immediately into the lumen of the intestine, because the union of the serous surfaces which are closely approximated is always, from the very first moment that the anastomosis has been made, stronger than the union of the tissues above the mesenteric angles, which were only loosely approximated and will heal by granulation. Another great advantage of the stitch recommended for the closure of the mesenteric angles is that it is not only very quickly made, but is safer than any other stitch, because it does not leave in the mesenteric space any suture material but the threads that pass through them. The importance of not leaving any foreign material in the mesenteric spaces has been already emphasized, and we shall here only mention the importance of avoiding as much as possible the presence of knots along any suture line made in the peritoneal organs. In a great number of experiments made, we have found that after a gastro-enterostomy or an intestinal anastomosis has been performed, the weakest points of the line of suture are the points where there are knots; we have proceeded in this manner in order to study the strength of different sutures. We have resected the gut that had been anastomosed or the stomach and intestine on which a gastro-enterostomy was performed at the intervals of from six hours up to fifteen days after the operation had been performed, and after having tied one end, water was forced through the other until the stomach or the intestine bursted; we have found that very often, that is, when the

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suture was perfectly made, the stomach or the intestine would burst not along the suture line but somewhere else up to twenty-four hours after the operation had been performed; after twenty-four hours, water would always leak through the line of suture and always at the points where the thread had been tied, and therefore a knot was present; we came to the natural conclusion that the point where there was a knot was the weakest of the whole line of suture, and therefore we tried to avoid the putting of knots when knots can be dispensed with, and we have devised the technic of making the intestinal anastomosis with just only one knot that is absolutely indispensable, and we tie it away from the attachment of the mesentery, that is, as we shall explain later, we tie it where the circulation is the best. So we cannot too strongly warn the surgeon against the use of separated stitches, which not only require so much more time, but which have many disadvantages. The line of suture is never absolutely even, because it would be impossible to put all the stitches at the same distance from each other; the tension on the line of suture is not evenly distributed, because it would be impossible to put the exact tension on each individual stitch; therefore, each stitch will work individually, with the result that if any tension is made on the suture line the tension will not be borne by the suture line as a unity, but by each individual stitch, some of which will be more taut than others and therefore will tear the tissues. From our numerous experiments we can positively state that the suture we have found to be the strongest is the one we have described, and the anastomosis made with just one row of sutures, as we have described, was found always to be far much stronger than the anastomosis made with any other method and with two or three rows of sutures from twenty-four hours up to any time after the sutures were made. As the suture we have described is also the most rapid, because the surgeon has to tie only one knot, does not have to change needles and thread, and can do the suturing very rapidly, we feel that there is absolutely no utility in resorting to sutures more complicated, not so strong, not so safe, and requiring more time. By putting the stitches at about three mm. from the cut edges, we obtain an inversion of about three mm. of serosa which is absolutely sufficient to insure a perfect sealing of the line of suture, and by putting the stitches close to each other we obtain a close union of the serosa without any pocketing or ruffling of the same, so that the line of suture appears as a straight line and, as said before, the two stumps of the intestine appear not sewn but glued together. We make about half the suture with each needle, because suturing with two needles makes the suture more rapid and easy, as it is more handy to sew from the mesentery to the top of the intestine, and because we do want to make the knot far from the mesentery. We have written that knots are the weakest point of the suture, therefore, we want to put the only knot where it might do less damage; that is, we have to put it where the tissues are best supplied with blood and we

believe that the points less supplied with blood are the points nearest the attachment of the mesentery to the intestine and therefore we make the knot away from them. In fact, it is sufficient to look at Fig. 3, which represents splendidly the circulation along an intestinal anastomosis made by the end-to-end method, in order to see, as clearly as daylight, that the idea held by many that the circulation along the border of the mesentery is best, because the blood-vessels come from the mesentery, is absolutely wrong. In fact, the picture shows clearly that the blood-vessels are all obliterated at the mesenteric angles and that therefore the circulation there is practically nil, while above the mesenteric angles the circulation is very good, because the blood-vessels anastomose so freely between themselves that they form a very intricate net of blood-vessels, which insures a good circulation along the cut edges. We do not, therefore, advise to tie knots along the mesenteric borders, but far from them.

If the stitch we have recommended is made carefully, inversion of the serosas takes place very easily and spontaneously; if this should not occur, the inversion is easily accomplished by gently pressing on the line of suture with a thumb forceps; we insist, however, that the inversion is essential to a good anastomosis; along the suture line no mucosa should be seen. We repeat again, an end-to-end intestinal anastomosis can be made very rapidly (about four or five minutes) with the technic we have described, but requires some surgical skill easily acquired by any one with enough surgical sense to enable him to do good general surgery, but the essential points on which we have insisted must not be neglected; they are all essential to make end-to-end intestinal anastomosis of the small and large intestine very rapid, easy of performance, and as safe as an end-to-end intestinal anastomosis can be made; the essential points are: Absolute hæmostasis between the two leaves of the mesentery, using the finest catgut or silk; good closure of the upper mesenteric spaces (angles), perfect approximation and inversion of the serosas all along the suture line, without any thread sticking out between the borders; avoidance of knots. All these points are essential, must not be neglected, and are not if the technic described is followed literally.

The only knot we use in our suture buries itself between the inverted serosas, if it is tied between them and the ends are cut short. Naturally, it would be better not to use any knot, but putting the knot as advised by us lessens to practically complete safety the dangers that might lurk in the presence of the knot.

The two leaves of the mesentery are then sewn up on both sides with a running stitch, because in this manner their cut edges are also inverted, so that we obtain a continuous line of serosa from the root of the mesentery up to all around the intestine; we recommend the running or the shoe-lace stitch described by us, because they are very quickly applied and invert the cut edges better than interrupted sutures which require a great deal of time. We recommend also to take a very superficial bite

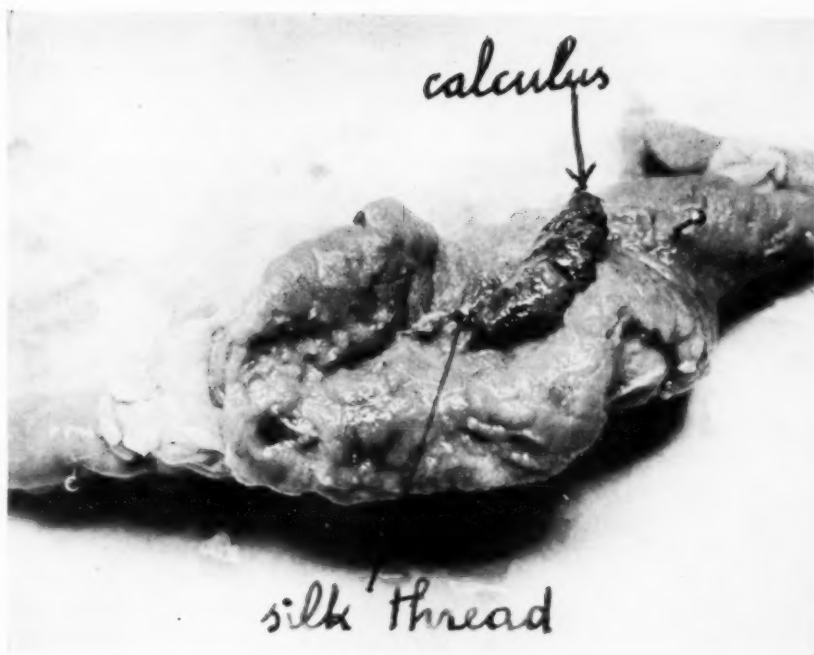


FIG. 17.—Showing a fecal calculus formed around a silk thread that was used in performing an anastomosis of the intestine.

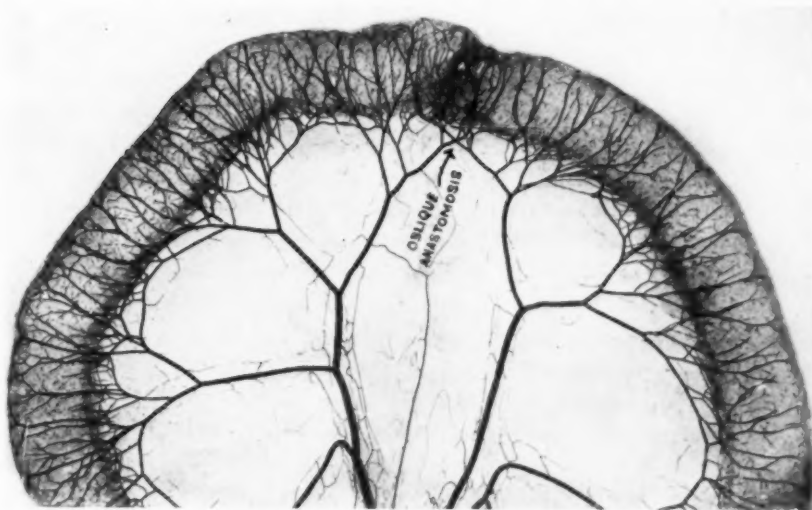


FIG. 18.—X-ray picture of circulation in a portion of intestine on which an anastomosis by the author's oblique method has been performed. Note that where the gut has been anastomosed the circulation is much more abundant than in any other portion of the intestine. The liberal supply of blood all along the line of anastomosis explains why the anastomosis made by the oblique method is much safer than the end-to-end.

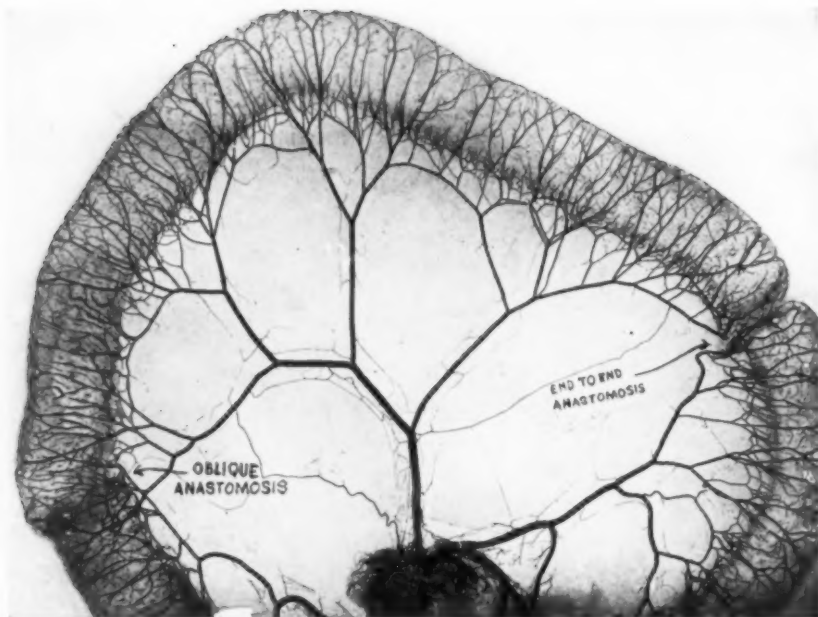


FIG. 19.—The X-ray picture of a loop of small intestine on which two anastomoses have been made, one by the end-to-end, the other by the oblique method is presented, in order to afford a comparison between the status of the blood circulation along the line of suture and especially at the mesenteric space (mesenteric angles). As shown in the other two pictures Figs. 3 and 18, the circulation of the intestine where an end-to-end anastomosis was performed is much poorer than the blood circulation of the portion where an oblique anastomosis has been done; compare specially the points marked with an arrow that indicates the status of the circulation at the mesenteric spaces, which is *nil* where an end-to-end anastomosis has been performed and very abundant where an oblique has been done.

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with the needle, because in this way there is no danger of perforating any blood-vessel, and it is not necessary to go deeply, with the idea of making the suture stronger, because the suture is strong enough even if only the most superficial layers are interested, the mesenteries not having to undergo any pulling and adhesion between the serosas sewn together taking place very rapidly. *The mesenteries of the two stumps of the gut that have been anastomosed must always be sewn together in order to avoid a hernia that might form if the gap is left open.* As we have stated, end-to-end anastomosis of the intestine would be always safe, as far as leakage from the upper mesenteric spaces (angles) is concerned, if the leaves of the mesenteries of each stump should form rapid and strong union, because the purulent material that forms in the upper mesenteric spaces (angles) would always leak through the loose union of the mucosa, submucosa and muscularis of the intestine, which, as we have stated, is the weakest point along the line of anastomosis. With the technic that we recommend we invert the cut edges of the mesentery, which have, as we have proved, no blood supply, and approximate the serous lining of the mesenteries away from the cut edges, that is, from points where the blood supply is still good, and so we facilitate their perfect union and so also prevent adhesions between the sewn mesenteries and other abdominal organs.

When performing end-to-end intestinal anastomosis, we do not advise the cutting away of any portion of the gut with the idea of making it wider, or of rendering the anastomosis safer; end-to-end anastomosis of the intestine has to be resorted to only when the anastomosis has to be performed in a great hurry, and the placing of special stitches, cutting away of mucosa, of portions of the cut edges complicate so much the operation that its performance requires more time than the performance of the oblique anastomosis described by the author in *Surgery, Gynecology and Obstetrics* and in *Policlinico*,<sup>2</sup> and which is the safest manner of anastomosing the gut. We refer to our papers on the subject and only show pictures of the general cut line of the disposition of the gut and its blood-vessels, that give to the reader an idea of how safe and rapid the method is (Figs. 18, 19, and 20).

*End-to-End Anastomosis of the Colon.*—A special mention should be made of the anastomosis between the small intestine and the colon, and between two stumps of the colon. The surgeon feels always more uncomfortable after the performance of an intestinal anastomosis in which one or both stumps belong to the colon than when both stumps belong to the small intestine. We have given already the reasons why anastomosis of the colon presents more danger than anastomosis of the small intestine, and we believe that Mummery is right when he states that side-to-side anastomosis of the colon or of the colon and small intestine is

<sup>2</sup> Soresi: A New Method of Lateral Anastomosis. Surg., Gyn. and Obst., February, 1915. Anastomosi intestinale obliqua. Policlinico, Surgical Section, November, 1918.

not to be recommended, specially on account of the long time required, the two pockets resulting from the closing of the two stumps, and because it is not possible, in every case, to loosen sufficiently and safely the two stumps that have to be overlapped. We do not agree, however, with Mummery when he states that the top of the gut should be resected because it is not well supplied with blood. The reason he gives for this supposed poor blood supply of the top of the gut is that the blood-vessels of the colon run parallelly to each other and do not anastomose freely. We do not contest the fact that the blood-vessels do not anastomose as freely as the blood-vessels of the small intestine, but we do believe that the blood supply of the colon is better far from the attachment of the mesentery than near it. What we have written above proves

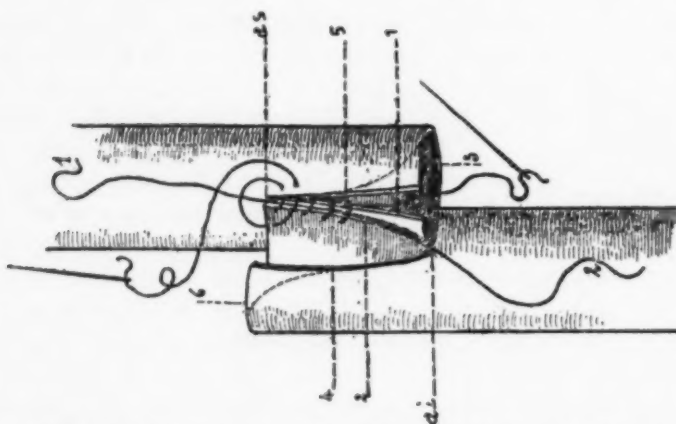


FIG. 20.—Disposition of the two segments of the gut when they are going to be anastomosed by the oblique method. Dotted lines show how angles can be rounded in order to make the performance of the anastomosis more even. In performing the oblique anastomosis borders 1 and 2 are sewn together, border 3 is sewn to border 4 and to part of border 6, border 5 to the portion left unsewn of border 6, so that the two segments of the gut overlap each other and the line of anastomosis is oblique and the point where the two segments are anastomosed is almost double in circumference compared with the lumen of the intestine; this will prevent any possible dangerous stenosis.

that our point of view is correct, and if another proof was necessary, we could find it in the fact that, after the blood-vessels have been tied along the mesentery, the cut edges of the colon always bleed, and at times they bleed so profusely that single blood-vessels along the cut edges must be tied, and it is better to do so before performing the anastomosis. Therefore, the same considerations we have made above hold good when the anastomosis of the colon is to be performed; we may be allowed to state, however, that we believe that our oblique anastomosis represents the ideal method of anastomosing the colon, because it is rapid, safe, avoids loosening the two stumps, the anastomosis is made along the natural axis of the intestine, avoiding the formation of any pocketing and rendering stenosis of the line of union practically impossible.

*Conclusions.*—The intelligent reader will easily understand why we condemn the use of the thermocautery, of disinfection with any chemical

compound; *they do only damage the tissues without avoiding in the least the inevitable infection*; moreover, by damaging the tissues they weaken the already low resistance of the same tissues and in this manner, instead of preventing or curing infection, they favor it.

As a conclusion we believe to be correct when we state that end-to-end intestinal anastomosis is not absolutely safe, because the tissues found in the mesenteric spaces (angles) are infected and their blood supply is practically nil, that in order to make it as safe as possible whatever can lessen the resistance of the tissues concerned in the anastomosis must be avoided, such as unnecessary traumata, blood-clots, great amount of suturing material, unnecessary infection, knots, tight sutures; the blood supply must be left in the best condition obtainable with a safe and perfect hæmostasis; all these desiderata are obtained with the technic we have recommended.

*Indications for End-to-End Anastomosis of the Intestine.*—When shall end-to-end intestinal anastomosis be employed in preference to side or oblique methods? The answer depends on the good judgment of the surgeon, who has to be guided by the following considerations, which seem to us very practical and reasonable: Given as basis for the considerations which have to guide the surgeon, that the same surgeon is really master of the technic of the surgery of the intestine, technically speaking there is no doubt that the end-to-end method is the most rapid of all methods by which anastomosis of the gut can be obtained. *It follows that the end-to-end method should always be resorted to in preference to any other method requiring more time, when, and only when, time is the most important factor that will help to save a patient's life.* By the expression that time would be the most important factor in saving a patient's life we mean to state that, given a patient whose probability of withstanding the resection of a part of the gut and consequent anastomosis depends on the rapidity by which the whole operation is performed, so that few minutes might have a great influence on the probabilities of his recovery, we think it more reasonable to perform an end-to-end anastomosis with any other method requiring more time. We base our reasoning on this consideration; supposing that the danger of losing the patient through leakage of intestinal contents into the abdominal cavity is 3 or 4 per cent. and the probabilities of losing the patient because the operation has required a longer time are 10 or 15 per cent., we give the patient the most favorable percentage, and the surgeon shall be guided by his own judgment in every particular case.

## DEFORMITY OF THE SCAPULÆ ASSOCIATED WITH A CERVICAL RIB AND A SPINA BIFIDA

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OF ST. LOUIS, MISSOURI

(From the Surgical Service of the Barnes Hospital and Washington University School of Medicine)

THIS case is reported particularly because of the unusual congenital malformation of the scapulæ and shoulder girdles. There is associated an anomaly of the cervical and upper dorsal vertebræ. A survey of the literature does not show a similar case.

The patient, M. E. B., No. 10,822, a white female, age twenty-two years, entered the Barnes Hospital because of a left pes cavus. Her family history and past history are negative. She complains of pain about the ankle and great toe of her deformed foot, which pain has been present since birth. General physical examination is negative except for her shoulder girdles and the left foot. The patient's appearance is striking. She holds herself with shoulders thrown forward, with a marked prominence of the suprascapular musculature (Figs. 1 and 2). The supraclavicular fossæ are obliterated and there is only a very shallow suprasternal notch. The neck is thick and short and she is unable to bend her head backwards. The movements of the arms are normal but there is restriction in rotation of the scapulæ in that she cannot fully elevate her arms. The trapezii and levator scapulæ muscles are active, the former being hypertrophied. The rhomboid muscles give no response on Faradic or Galvanic stimulation. There is marked prominence of her seventh cervical vertebra, just below which there is a depression, marking the site of a spina bifida occulta. There is an impulse over this area on coughing. At the edge of the sternum, below the sternoclavicular joint, there is a nodule which appears to be in the cartilage of the first rib. The left foot has some shortening of the tendo Achillis, with marked shortening of the plantar fascia, causing a curvature of all toes of the foot. Urine negative. Blood Wassermann negative. Temperature and pulse normal.

X-ray plates show the scapulæ in an abnormal position (Figs. 3 and 4, No. 3); they are symmetrically placed near the vertebral column and are two ribs higher than in a normal individual. In this case the root of the spine of each scapula is at the level of the superior angle. The spine is overdeveloped, terminating in a very broad acromion. The coracoid appears normal. At the vertebral border of the scapulæ, reaching over to the defective vertebræ, is an extra plate which seems to be articulated with the scapulæ (Fig. 4,



FIG. 1.—Position in which patient holds her shoulders.



FIG. 2.—Position in which patient holds her shoulders.

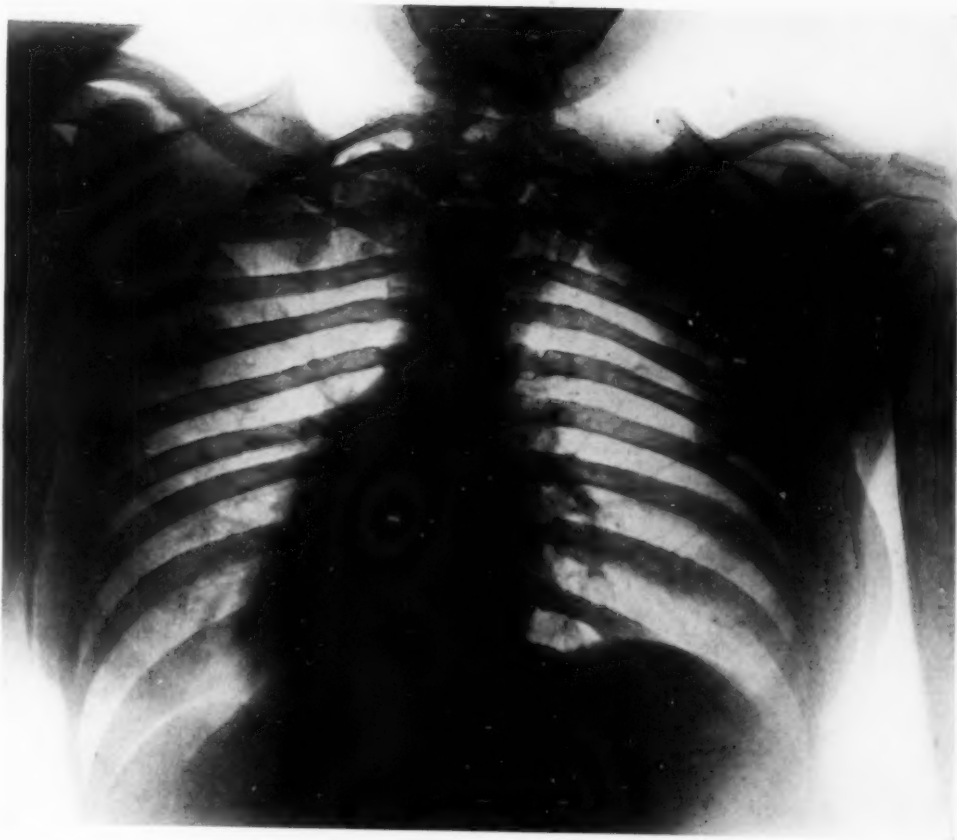


FIG. 3.—Reproduction from stereoscopic X-ray plate showing anomalous bony plate, cervical rib and spina bifida. Plates taken in supine position.

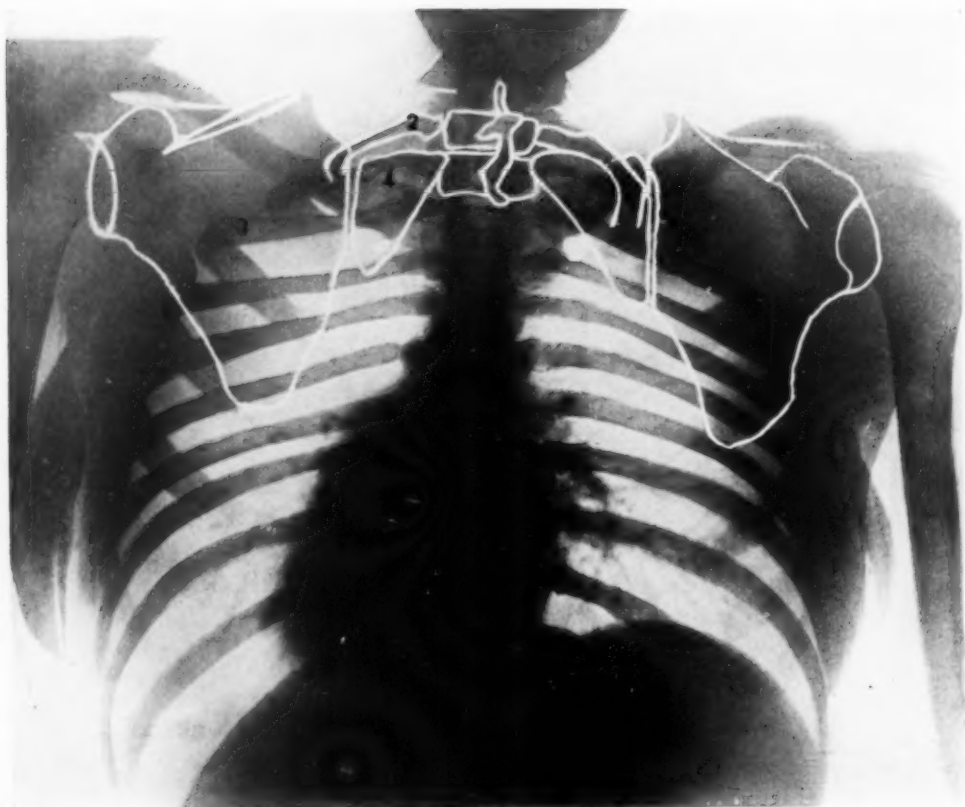


FIG. 4.—Same picture as Fig. 3, with the prominent features outlined. 1, spina bifida; 2, cervical rib; 3, scapula; 4, extra bony plate; 5, white spot—small nodule of bone.

## DEFORMITY OF THE SCAPULÆ

No. 4). Extending upwards the apex of the plate reaches nearly to the first thoracic vertebræ. There is a hiatus in the seventh cervical, first, and second dorsal vertebræ (Fig. 4, No. 1). The clavicles are curved in their lateral third and, being broadly expanded there, present a more robust development than is typical in women. There is present a cervical rib (Fig. 4, No. 2) which curves around and seems to be attached at the edge of the sternum below the sternoclavicular joint, at the site of the nodule of bone (Fig. 4, No. 5) which was palpated there.

The abnormalities of position and form in the shoulder girdle may be attributed to the spina bifida and the triangular bony plate. The normal rhomboid musculature arises in part from the spinous process of the first thoracic vertebra, which vertebra in the present instance is absent. Apparently, the rhomboids are defective also; it may be that the triangular plate has replaced them. One important function of the rhomboids is support of the shoulder blades. In their absence, or if defective in development, the weight of the shoulders may be expected to fall somewhat on the other muscles which share with the rhomboids the maintenance of the normal position of the shoulder girdle, *i.e.*, the upper portion of the trapezii and the levator scapulæ. These two groups of muscles seem to have compensated well for the additional work thrown upon them by the absent or non-functioning rhomboids, and have drawn the shoulder girdles above their usual level. Contrary to the above interpretation, the elevation of the shoulder girdles may be regarded as a persistence of the cervical relation of the girdle as found in the embryo; the spina bifida as an arrest of the development of the vertebræ, with no influence on the position of the girdle, and the triangular plate as a "Reversion of Type."

The scapula is rarely absent and rarely malformed. The most common variation met with is a separated acromion process. Very much rarer are the cases in which the coracoid process is separated from the rest of the bone. There is a chief centre of development for the scapula proper and one for the coracoid, besides an indefinite number of accessory ones. The first centre appears about the eighth week at the neck and forms nearly the whole bone, including the spine, the root of the acromion, and the dorsal part of the root of the coracoid. The coracoid centre appears in the first year; it forms also the top of the glenoid cavity, and at fourteen or fifteen fuses with the first centre, beginning to unite on the ventral surface. At about fifteen years many nuclei appear in the acromion and fuse. A year later the mass so formed joins the body—sometimes this remains connected by fibro-cartilage. About seventeen or eighteen years nuclei appear; one in a strip along the posterior border, and one at the lower angle. Both are fused by twenty years of age, but the lower one is one of the last to fuse in the skeleton. The occurrence of a special primary centre for the coracoid process is of

morphological importance, in that the process is the representative of a distinct coracoid bone in the lower vertebræ.

The anomalous triangular plate of bone appears in the spot where a precocious development of the normally occurring epiphysis could account for it. It might be regarded as an ossification of an abnormal suprascapular cartilage. A suprascapular cartilage is not an uncommon part in the scapular in mammals, and is the rule in the lower vertebrates. However, a supraclavicular bone is developed in very few mammals beyond an epiphysis, or as an incomplete calcification of the suprascapular cartilage.

In medical literature there are reported numerous cases of extra ribs found in adults, both at the cervical and lumbar ends of the thoracic ribs, but more often at the latter site. Pillings reports a case of seventh cervical ribs that joined the sternum in the manner of true ribs. Persistent ribs are more frequently incomplete and fail to make a sternal attachment. The first pair of thoracic ribs are sometimes incomplete. The X-ray plates of this patient show an incomplete cervical rib extending about two-thirds of the way to the sternum. A small bony nodule previously described, lies at the site where the rib would apparently be attached were it complete. Possibly the rib is joined to the sternum by a ligamentous or cartilaginous band, with ossification of a small portion of the sternal end.

This case is of some interest phylogenetically. The elevation of the shoulder girdle recalls Gegenbaur's Gill Arch theory and the more modern Balfour's Fin Fold theory for the origin of the lower group of vertebræ. The cervical rib suggests the reptilian origin of mammals.

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# TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY

*Stated Meeting, held March 12, 1919*

The President, DR. CHARLES H. PECK, in the Chair

## OPEN OPERATION FOR FRACTURE OF PATELLA

DR. JOSEPH WIENER presented a patient, thirty-four years of age, who was admitted to Mt. Sinai Hospital, August 15, 1917. On day of admission he fell on left knee and sustained a fracture of the patella. The knee was swollen and the joint contained fluid. Flexion limited to 10°. Crepitus was felt and the patella was very tender. Several fragments could be felt widely separated.

Operation five days after admission. Five inch horseshoe flap over patella. Clots removed from joint and two large fragments of bone united with chromic gut after drilling holes through the fragments. Capsule sutured with chromic gut. Wound healed by primary union. Functional result very good.

DR. CHARLES L. GIBSON asked whether he understood correctly that Doctor Wiener operated on the fractured patella on the fifth day and regarded that as early? He has nearly always operated for fractures of the patella on the fifth day and has regarded that as the time of election rather than a later date, and he may say that his results have been uniformly good.

DR. JAMES M. HITZROT said his experience agreed with that of Dr. Gibson. He operated upon the fifth day and had had no infections. The essential feature was the proper preparation of the skin for operation in his opinion. Some years ago the question of immediate operation *versus* later operation in fractured patella had been discussed. The features, which in his experience contraindicated immediate operation, were the exudation into the joint and the infiltration of the torn tissues subsequent to the operation, which materially interfered with the approximation of the bone fragments and the torn ligaments; and probably caused the approximating sutures to cut through.

Two parallel series of cases of ten each were then operated upon—ten immediately and ten at the five day interval. Exactly similar operations were done and there was no other contributing cause in the result. In the ten cases operated upon immediately, the functional result was not as good and extension was not as complete nor as strong as that obtained in the cases at the five day interval. The delay also allowed for the hemorrhage to stop and for the proper skin preparation and was more preferable than the immediate operation.

DR. LUCIUS W. HOTCHKISS said he had one case of fractured patella by direct violence last summer caused by the patient's falling from a horse. He operated a little earlier than usual in this case, but as a rule he did not operate early in these cases.

DR. JOHN DOUGLAS said that some ten or fifteen years ago Dr. Carlton Flint wrote a paper in which he analyzed a large number of cases of fracture of the patella. He considered the figures in cases operated on early and those operated on after a period of time, and he showed that the results of the later operations, that is, a week or ten days after the fracture occurs, did better than the cases operated on earlier. He gave as a reason, that the amount of exudate causes a separation of the fragments and also that suppuration was more apt to take place after the suture of bruised tissue which has lost its resistance. He, Doctor Douglas, always allowed his cases to go a week before operating. He thought we gained nothing by an early operation inasmuch as the resistance of the tissues is better at a later period, and firm union of the bone occurs just as soon as if an early operation were done.

DR. PENN G. SKILLERN, JR. (by invitation), stated that the practice in dealing with fresh fractures of patella in Philadelphia is quite the same as that outlined by those who discussed Doctor Wiener's case. He, personally, followed the teachings of the late Dr. John B. Murphy, who stressed the importance of giving the tissues time to coffer-dam themselves against infection from without by erecting a barrier of leucocytes and closing the open lymphatics: for this usually from five to eight days were allowed.

Personally, Doctor Skillern agreed with Doctor Hitzrot; for as a practical proposition no time in the process of repair is lost by waiting for coffer-damming to take place, especially since in a fracture lime-salts are rarely deposited before the fourteenth day.

DR. CHARLES H. PECK remarked that it seemed a pretty well accepted principle to-day to delay the operation for a time in these cases of fractured patella.

#### EXCISION OF TUMOR OF THE CAROTID BODY

DR. JOSEPH WIENER presented a patient, thirty-seven years old, who was admitted to Mt. Sinai Hospital, December 9, 1918. Eight years before admission she first noticed a swelling on the left side of the neck. This has slowly increased in size without causing any pain. On examination he found a swelling in the upper angle of the anterior triangle of the neck about the size of a small hen's egg. It was elastic to the touch and rather freely movable under the skin. There was no tenderness. The thyroid gland was not enlarged.

Operation under gas and ether. Incision started behind the angle of the jaw downward and forward. The tumor was very vascular and fixed to the deeper structures. Bleeding was very profuse from numerous enlarged veins and from many smaller arteries. Owing to the severe hemor-

## EXCISION OF TUMOR OF THE CAROTID BODY

rhage the incision was quickly extended downward to the clavicle. The internal jugular vein was enormous, measuring an inch in diameter; the common carotid was also very large. Both these vessels were doubly ligated with silk without being cut. As the bleeding from the tumor did not cease the patient was given an intravenous injection of saline solution. Numerous large vessels above the tumor were then clamped and ligated. This finally checked all bleeding. The tumor with the bifurcation of the common carotid incorporated in it was then dissected free and removed by cutting across common carotid and internal jugular. The wound was closed with drainage.

The specimen consisted of a two-lobe tumor, firm and hard, about two inches in diameter, with the common carotid and its bifurcation and the concurrent veins incorporated in it. Following operation there was some left facial paresis with marked weakness of right arm and leg. For several days morphine had to be given to control coughing spells. On December 17 the laryngologist verified paralysis of left vocal cord. All symptoms of paresis and paralysis soon disappeared. Coolidge treatment is being given regularly and there is no sign of any relapse.

Pathologic diagnosis was perithelioma.

DR. JOHN DOUGLAS stated that some years ago he had a patient with perithelioma of the carotid body which he reported and, during the discussion which followed, someone remarked that most of these tumors recurred. He operated on this patient eight or nine years ago and was able to follow the patient for six years, and up to that time there was no recurrence. He believes the tumor starts in the bifurcation of the carotid and spreads around the vessel, and the reason the carotid appears to go through the tumor is that the tumor grows in such a way as to surround the blood-vessel.

DR. WILLIAM B. COLEY said he had a tumor of the carotid body in which the growth was located at the bifurcation. He operated on this patient at the New York Hospital. The tumor was closely adherent to the blood-vessel, making the operation very difficult. The tumor was removed, however, and the patient remained well for a year or two, when he lost track of him, so he could not say whether or not he was still alive.

DR. WINFIELD S. SCHLEY said he had a case about three years ago with a tumor at the bifurcation of the carotid artery in which he ligated all three branches and removed the tumor with the vessels. He saw this patient the other day, about three years after the operation, and there were no signs of recurrence. He reported this case before the Surgical Society and it made the seventy-fourth or seventy-fifth case in the literature. In a review of these cases he found that the prognosis was fairly good but it was vastly better where the tumor and vessels were removed together. In the cases in which enucleation was practised without vessel excision there were recurrences, as he remembered, in fully 50 to 60 per cent. of the cases.

DOCTOR PECK asked if, in this series of cases mentioned by Doctor Schley, there were many cerebral symptoms following the ligation while the collateral circulation was being established.

DOCTOR SCHLEY said he did not think there were.

DOCTOR WIENER, in closing, said he thought the prognosis would be improved by the Coolidge treatment. He now had a Coolidge apparatus in his office and he was using it after operation in all superficial growths that are malignant or suspicious of malignancy. He thinks this treatment is powerful in preventing the recurrence of carcinoma.

He had one patient who, after an operation for carcinoma of the breast, had a recurrence in the sternum, the tumor being as large as a hen's egg. It disappeared entirely under the Coolidge treatment and three months later X-rays taken with the patient in three different positions showed no trace of the tumor. Doctor Erdmann and Doctor Gibson saw this patient at the time she had the tumor in the sternum. She subsequently succumbed, however, to a cerebral metastasis. He used the Coolidge treatment a great deal and he expected to continue to use it in more and more cases.

#### COMPLETE DISLOCATION OF ANKLE WITHOUT FRACTURE OF LEG BONE

DR. SETH M. MILLIKEN presented this case because before seeing it he had believed that such a condition was impossible and he had in his library no record of a case presenting so much derangement of the mortise of the ankle without an associated fracture.

On May 21, 1918, a large, very heavy man, about thirty-eight years old, with marked flat feet, a chauffeur by occupation, was standing in an elevator when its cable parted and the elevator dropped one and a half floors, 15-20 feet, and stopped with sideways tilt. The jar twisted his right ankle so that he was unable to walk. He was helped to Roosevelt Hospital, where Doctor Milliken saw him immediately. Examination showed the foot apparently rotated to a right angle outward. The lower extremity of the tibia was projecting under the tense skin with a very slight wound over its tip and felt as if the entire lower surface was completely displaced from the astragalus. The fibula was bent outward and its outer surface could be easily palpated its entire length. He examined for a fracture but was unable to find one, so had an X-ray taken. To his surprise, the plate showed no fracture but showed an outward dislocation of the astragalus from the tibia. The astragalus was jammed up between the outer surface of the tibia and the unfractured fibula, wedging them apart. Reduction of the dislocation was very easily accomplished by traction and slight rotation and the astragalus jumped back into place. Subsequent X-rays showed the ankle restored to its habitual position. A plaster cast was applied from the toes to the knee. This was removed on June 1 and the angle re-supported in firm Gibney's strapping. No

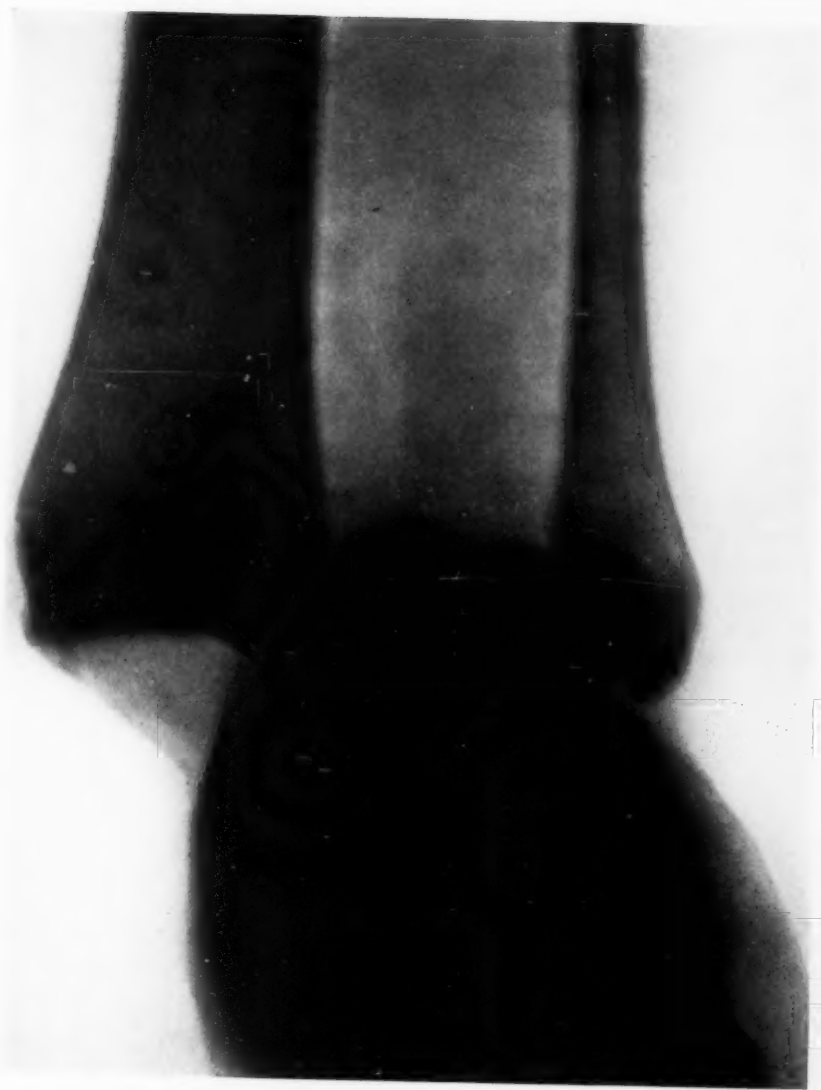


FIG. 1.—Before reduction. Plate of entire leg showed no fracture.



FIG. 2.—Before reduction. Shows upward displacement between leg bones.



FIG. 3.—After reduction. Moulded splints applied.



FIG. 4.—After reduction. Moulded plaster of Paris splints applied.

## FIBROMA OF THE ABDOMINAL MUSCLES

weight-bearing was allowed but active motion was encouraged until June 17, after which walking was begun. On July 3, the patient could walk a short distance without discomfort and had almost as much motion in the injured as in the uninjured ankle. At the present time he has pain, especially when weight comes on front of foot.

DR. JAMES M. HITZROT said the case was undoubtedly unique. Dupuytren described a group of fractures in which the inferior tibiofibular ligament was torn, the fibula fractured in which the astragalus ascended between the bones, but that he knew of no similar case to that presented by Doctor Milliken.

DR. NATHAN W. GREEN said that he had had a case somewhat like Doctor Milliken's, in which Doctor Hotchkiss was called in consultation. The patient had been sliding down hill with her little daughter. She caught her foot in an iron fence and dislocated the astragalus completely inward, compounding it completely. When she arrived at the house the astragalus was lying out in the bedclothes and there was apparently no fracture of the leg bones. Close inspection of the X-ray showed a fracture of the tibia about eight inches above the joint, but there was no deformity. The astragalus was completely dislocated and it could not be replaced and so he snipped off a small strip of ligament and removed it.

### FIBROMA OF THE INTERNAL OBLIQUE AND TRANSVERSALIS MUSCLE

DR. NATHAN W. GREEN presented a patient with the above condition. He accompanied the presentation with a brief paper on the condition, for which see page 600.

DR. JOSEPH WIENER said he had had two cases very similar to the one Doctor Green has presented, both in women. One had a small growth in the right lower part of the abdomen, which could be enucleated, while the second was in the right upper quadrant and was not encapsulated but was infiltrating the muscle tissue. As no pathologist was present at the time of the operation to make an immediate examination and he feared malignancy, he made a wide incision. He then found it was very difficult to close the incision. He devised a large wire filigree and fortunately this wire filigree stayed in place. He later found that the growth was not a sarcoma, but the character of the tumor, resembling a fibromyoma and being about three-fourths encapsulated and one-fourth perforating through into the muscle, deceived him into thinking that he was dealing with a malignant tumor.

DR. CHARLES H. PECK said he had a case of fibromyoma of the internal oblique and transversalis on the left side very similar to this one presented by Doctor Green. It was not well encapsulated, but merged into the internal oblique and transversalis. There was no vascular pedicle. He made a wide excision in removing the tumor, leaving a large defect to be closed. Closure was effected with some difficulty but successfully; no hernia resulted. He followed the patient for seven years and she was all right up to that time. He had a second case that hardly belongs in

the same class, although it had similar features. It was a fibrous tumor of the abdominal wall studded with calcareous nodules. It proved to be malignant, as the patient died subsequently of a metastasis.

DOCTOR GREEN, in closing, said he had nothing to add except that he had had another case with a tumor similarly situated in the muscles, but he could not recall whether in the internal oblique and transversalis or not. He remembered that it could not be shelled out. In this case presented this evening the tumor did not involve the external oblique in any way, so, although he made a wide excision and had a very large defect, the rectus and the external oblique were still intact. This enabled him to make a good closure.

#### INTRA-PERITONEAL ABSCESS DUE TO FISHBONE PERFORATION OF INTESTINE

DR. WINFIELD S. SCHLEY presented a small boy, nine years of age, who was admitted to the hospital a year ago. Several weeks before his admission he complained of indefinite abdominal pain. Three days before the pain recurred with considerable severity and localized upon the left side near the umbilicus.

The family history was negative. The boy has been rather careless as regards his bowels and had been a rapid eater.

At the time of admission he had an acute intra-abdominal condition with rigidity, etc. There was a mass on the left side extending below the umbilicus and under the left rectus muscle. On opening the abdomen the omentum was found to be wrapped in a ball-like mass completely around an abscess, and was in contact with the descending colon and the small intestine behind to both of which it was adherent. On opening the mass it was found that quite a large (codfish) bone had perforated either from the large or small intestine; it was impossible to say which. The discomfort which the boy experienced prior to the acute onset was probably at the beginning of the perforation of the gut. He excised the mass of omentum and placed in a small rubber drain. No other abnormality was present. The boy made a good recovery.

In the specimen presented the protective action of the omentum in such accidents is well shown.

#### INOPERABLE MELANOTIC SARCOMA OF THE NECK; ENTIRE DISAP- PEARANCE UNDER ACCIDENTAL STREPTOCOCCUS INFECTION; PATIENT WELL MORE THAN THREE YEARS

DR. WM. B. COLEY presented a little girl, aged seven and one-half years, who was referred to him for observation by Dr. Robert C. Bryan of Richmond, Va., with the following history:

On June 20, 1915, when Doctor Bryan first saw the patient, there was enlargement of the neck with involvement of the cervical glands. This had been noticed for about four months. The swelling first began in the

## INOPERABLE MELANOTIC SARCOMA OF THE NECK

left jaw and two weeks later was also noticed in the right side of the neck. The child had always been in the best of health up to this time. An examination was made by Dr. F. W. Mercer, who pronounced the throat, nose and ears normal. A physical examination showed the submaxillary, cervical and supraclavicular glands symmetrically enlarged and matted together, the enlargement being more pronounced on the left side. A probable diagnosis of Hodgkin's disease was made. Blood examination was negative.

On July 7, 1915, a small incision was made over the submaxillary gland at the angle of the left jaw and two small glands were removed for microscopical examination, which was made by Dr. S. B. Moon of the Medical College of Virginia, who reported:

The sections are composed mainly of actively proliferating embryonal connective-tissue cells, mainly spherical, but varying widely in shape and size. An occasional giant cell is seen. The vessel walls are thin or lacking, and when present intimately associated with the tumor cells. In some areas pigment granules, apparently melanin, are abundant in the cell protoplasm. Fibro-elastic tissue, fat and striated muscle are definitely infiltrated by the tumor cells in their advance. Diagnosis: Melanosarcoma.

The case was quite inoperable and a hopeless prognosis was given the parents. The tumor slowly increased in size until December 25, 1915, at which time there was also beginning emaciation. On December 26, the neck began to enlarge very rapidly, became red and swollen, temperature rose to 106° and pulse 180. There was marked cyanosis, great dyspnoea, and evidence of severe infection in the tumor. On December 27 the child became unconscious. On the following day under primary anaesthesia a median incision was made under the jaw, a large amount of sero pus being evacuated (2 to 3 ounces). A specimen was examined by Doctor Moon, who reported: "Pus from neck is streptococcic with various saprophytes."

The infection slowly subsided but the wound remained open for several weeks. The tumors of the neck gradually decreased in size and in a short time entirely disappeared. The child has remained in good health up to the present time, three and one-quarter years later. Doctor Coley added that a microscopical examination of the specimen removed was also made by Doctor Ewing, who confirmed the diagnosis of melanoma.

Doctor Coley states that in the 68 collected cases of malignant tumors in which an attack of intercurrent erysipelas was immediately followed by great improvement in the local and general condition of the patient, one of these cases, in which entire disappearance of the tumor took place, was a melanotic sarcoma. Doctor Coley stated that the melanotic sarcomas or melanomas had been the least favorably influenced by the mixed toxins of erysipelas and bacillus prodigiosus of all types of malignant tumors. Still, there had been a few cases in which the tumors had entirely disappeared, and three or four patients that have apparently remained perfectly well. Doctor Coley stated that he personally had had

few encouraging results, but that he had just learned of a four-times recurrent melanotic sarcoma of the neck in which the toxins were used in December, 1914, by the patient's husband, a physician, who recently wrote that his wife was in the best of health with no evidence whatever of a recurrence. As to cases of melanotic sarcoma, in the early case that was associated with pressure symptoms the tumor entirely disappeared after the infection. In another case coming under his observation a complete disappearance of the tumor followed an attack of erysipelas. Doctor Lilienthal and Doctor Greenwood have reported similar cases. Doctor Greenwood's case occurred in a boy seven years of age and the growth entirely disappeared after an attack of erysipelas. His experience with melanotic sarcomas is that he has not been very successful in treating them with radium, with one exception. This patient was the wife of a physician who had had four operations and had had a piece of the growth removed for examination. In December, 1914, he began treating her with radium and the X-ray, and she began to pick up and continued to improve. He saw her only a few days ago when she was still perfectly well. As a rule, radium and the X-ray have less effect on these tumors than on tumors of any other variety. As for the tibia case he could not say it was cured, but an amputation had been avoided and the periosteal growth inhibited. There were very few cases of this kind that have gotten well even after high amputation and where the growth had been a primary one.

PERIOSTEAL SPINDLE-CELLED SARCOMA OF THE TIBIA, WITH METASTASES IN THE INGUINAL AND FEMORAL GLANDS; DISAPPEARANCE UNDER TOXIN AND RADIUM TREATMENT; WELL AT PRESENT NEARLY TWO YEARS

DR. WILLIAM B. COLEY presented a man, thirty-nine years of age, who was referred to him on April 27, 1917, by Dr. John H. Gibbon of Philadelphia. Family history negative. Personal history: The patient's general health had been very good, and he had practically never been ill. Ten years before, he was struck by an automobile and suffered a compound fracture of the right leg, four inches above the ankle. There had been no injury to the left leg as far as known. Four weeks before he was referred to Doctor Coley, the patient noticed a swelling about two inches above the left ankle, extending upwards and involving the inner and anterior portion of the leg for a distance of six inches. It was at first believed to be a periosteitis of inflammatory origin. In the latter part of April Doctor Gibbon was called in consultation, and pronounced it probably sarcoma. This opinion was strengthened by an X-ray examination.

Physical examination at the time of Doctor Coley's first observation (April 27, 1917) showed a man in robust health. Examination of the left leg revealed a marked swelling occupying the lower third, apparently originating in the periosteum and extending nearly around the leg. It began about an inch above the internal malleolus and extended upwards

# PERIOSTEAL SPINDLE-CELLED SARCOMA OF THE TIBIA

five inches anteriorly, and  $4\frac{1}{2}$  inches on the outer side of the fibula. There was marked œdema of the whole lower third of the leg extending to the ankle. The swelling, which was most prominent over the inner and anterior part, was soft, almost semi-fluctuating, and markedly tender on deep pressure; the skin was slightly discolored. T. =  $99:5^{\circ}$ .

Doctor Coley believed it probably sarcoma but thought it most important to settle definitely the diagnosis, and on April 27 made an exploratory operation. A portion removed was examined microscopically by Doctor Ewing, who reported: "Section shows a tumor composed of small spindle cells consisting chiefly of nuclei. They are very numerous, with no visible stroma. The cell masses are very compact. The tumor is quite malignant in structure."

The patient was immediately put upon the mixed toxins of erysipelas and bacillus prodigiosus, which were continued 4 or 5 times a week in doses sufficient to produce a temperature of  $102-104^{\circ}$ .

*Measurements* (April 30, 1917).—1 inch above the internal malleolus,  $9\frac{5}{8}$  inches; 4 inches above the internal malleolus,  $10\frac{5}{8}$  inches; 6 inches above the internal malleolus,  $10\frac{3}{4}$  inches. The tumor itself, anteriorly,  $5\frac{1}{2} \times 5$  inches.

May 5, 1917.—4 inches above internal malleolus,  $10\frac{3}{8}$  inches; 6 inches above internal malleolus,  $10\frac{3}{8}$  inches. The tumor itself,  $4\frac{1}{2} \times 4 \times 3\frac{1}{2}$  inches.

May 11, 1917.—4 inches above the internal malleolus,  $9\frac{3}{4}$  inches; 6 inches above the internal malleolus,  $9\frac{3}{4}$  inches. The tumor itself,  $4 \times 3 \times 2$  inches.

On May 1, 1917, the patient was treated with radium emanations 12 x 85 mc. (1020 mc.) through 2 mm. lead filter, 6 cm. distance, applied to the anterior surface of the leg for twelve hours.

On May 8, he received the following radium emanations: 660 mc., 2 mm. lead filter, 10 cm. distance, applied to the inner aspect of the leg for twelve hours, and on May 23, the same amount of radium emanations, 2 mm. lead filter, 6 cm. distance, applied to the external aspect of the leg for twelve hours.

X-ray examination by Doctor Quick, May 14, 1917, showed: "In the lower half of the left tibia there is an area of bone 13 cm. in length and embracing for the most part the anterior and inner side in which the bone, both cortex and periosteum, is involved by a destructive and rarefying process.

"Diagnosis: Periosteal sarcoma."

*Measurements* (May 21, 1917).—Circumference of leg across centre of scar,  $9\frac{1}{4}$  inches.

May 25, 1917.—Circumference of leg across centre of scar,  $9\frac{1}{4}$  inches; upper end of scar,  $9^{\circ}/_{16}$  inches; lower end of scar,  $9^{\circ}/_{16}$  inches; at malleoli,  $9\frac{3}{4}$  inches.

On May 26, 1917, the patient returned to his home, where the toxins were continued three times a week by Dr. R. G. Gamble, his family physician, and on June 19 he was again admitted to the Memorial Hos-

pital for further radium treatment, at which time he received 1200 mc. emanations, through 2 mm. lead filter, 10 cm. distance, applied to the internal surface of the leg for eight and one-half hours. The toxins were then continued at home during June and July, but in view of the fact that all evidence of the disease had disappeared and he was in such fine general condition it was thought safe to discontinue the treatment for four weeks during the extreme heat in August and September.

X-ray examination by Doctor Quick, July 2, 1917, showed: "As compared with plates of a month ago there is distinct improvement in that the bony outline is less ragged and tending to a sclerosis."

The patient returned to Doctor Coley for observation on September 15, 1917, stating that he had recently discovered swellings in the left groin, which were increasing in size. A physical examination showed the leg to be apparently normal. The left groin was occupied by several large glands involving both the inguinal and iliac regions, the largest of which was about the size of a big hickory nut. Doctor Coley removed one of these under general anæsthetic and forwarded it to Doctor Ewing for microscopical examination, who reported: "Actively growing sarcoma. Cells large polyhedral. No pigment. Nature of origin uncertain."

*Radium Treatments* (October 1, 1917).—Radium emanation pack 600 mc. for seven hours, 2 mm. lead filter, applied at a distance of 10 cm. to the left inguinal and femoral regions.

October 2, 1917.—Radium pack, 480 mc., 2 mm. lead filter for twenty-nine hours, at a distance of 10 cm. to the same region, making a total of 18,120 mc. hours.

November 8, 1917.—Radium pack, 1400 mc. (2 mm. lead, 0.5 mm. German silver) applied at a distance of 8 cm. over the left inguinal region for six and three-quarter hours.

November 9, 1917.—Radium pack, 1420 mc. (2 mm. lead, 0.5 mm. German silver) applied at a distance of 8 to 10 cm. over the left inguinal region for six hours.

December 7, 1917.—Radium pack, 1800 mc. for six and two-third hours (2 mm. lead, 0.5 German silver) applied over the left inguinal region at a distance of 8 to 9 cm.

The toxins have been continued up to the present time with occasional intervals of rest. The doses have been comparatively small, not sufficient to interfere with his regular occupation, and his general health has remained perfect throughout the entire time.

A recent physical and X-ray examination showed apparently no trouble remaining in the tibia, and no evidence of metastases in any other part of the body.

This case, Doctor Coley believed, illustrated the advantage of combining the local effect of radium with the systemic effect of the toxins; it also showed the importance of keeping up the toxin treatment in certain cases for a considerable period. Doctor Coley added that it was too

## REPAIR OF VENTRAL HERNIA

early yet to say that the patient was permanently cured, but nearly two years had elapsed since the disappearance of the primary tumor, and one and one-half years since the secondary one.

## REPAIR OF VENTRAL HERNIA

DR. CHARLES L. GIBSON presented a patient who was shown here three years ago and was presented again now to demonstrate the permanency of cure. At that time he also showed a patient whose operation now dated back five years. He was unable to show her to-night as she was now in California, but a recent report from her stated that she was absolutely well and was able to take vigorous physical exercise.

The operation was applicable to any form of ventral or umbilical hernia and particularly in the repair of large post-operative incisional herniæ. The essential step of the operation was the utilization of pedunculated flaps of the anterior sheath of the rectus muscle, these flaps being cut exactly as are Langenbeck's flaps in the repair of cleft palate. The length and width of these flaps varied according to circumstances, but the result must always be the possible approximation of the refreshed free edges as in ordinary suture of abdominal wounds. The rest of the operation—closure of peritoneum, dissection of recti muscles, etc.—was the same as in ordinary laparotomies. It would seem at first sight that a weak place was left in the abdominal wall produced by the gap in the fascia of the rectus. Ordinarily, the rectus muscle underlies this and there was no trouble, but even in cases with such a deficiency, the results had been uniformly good.

He had hoped to show a patient who illustrated the extreme possibilities of this method but she had not come. However, he said if the members present would permit him he would say a word about her case. She was an Italian woman operated on in 1902 in the New York Hospital. After this she had had an epigastric hernia, repaired in August, 1912. In September, 1913, she had returned with a ventral hernia which had been repaired, using silver filigree  $4\frac{1}{2}$  inches by  $3\frac{1}{2}$  inches. In October, 1918, the wire broke through, causing pain. It was found that there was bulging at the site of the previous operation and the wire filigree was broken and a discharging sinus was present. The wire filigree could not be pulled out. He decided to make this a test case. Under local anæsthesia he removed the wire filigree and he then had a large infected wound which he simply closed with drainage. Later the operation as described was done. There was some difficulty with the infection but he finally succeeded in getting union. It was now three months since the operation and he had tried to bring her here to show that she had a perfectly good abdominal wall at this time. The last operation was performed on November 23, 1918. He believed this operation is suitable for the repair of any hernia unless it is an umbilical hernia, and even for an umbilical hernia he believed it was surer than the overlapping operation.

DR. JAMES M. HITZROT said that Doctor Gibson did not give himself sufficient credit for the difficulties encountered in that case. The woman had been operated upon twice for the hernia. The first operation (Doctor Hitzrot) was the ordinary type with dissection of the edges and approximation of the edges under tension. She developed bronchitis after the operation and the hernia recurred. At the second operation there was a large gap and to fill this a six-inch prepared silver wire filigree mat was used to fill the defect. This cured the hernia and had not caused her any trouble until three months ago when a sinus formed and began to discharge.

This was undoubtedly due to the broken wires in the filigree as the sinus only formed over the sharp edges of the broken wires.

The difficulty after the removal of the filigree was the closure of an eight-inch gap which the operation which Doctor Gibson has devised very ably met. The operation has very successfully replaced the use of foreign material to close these large ventral herniæ.

DR. WILLIAM B. COLEY stated that he believed Doctor Gibson's operation to be a distinct advance in dealing with this kind of a ventral hernia. Personally, he was opposed from the first to the use of filigree wire in any type of operation, because of the end-results which he had observed in cases in which it had been used. In some cases the wire had broken up into small pieces which had found their way into different parts of the abdomen, some entering the bladder and causing vesicular calculi. Doctor Coley referred to a monograph written by a German surgeon two years ago, on obscure tumors due to filigree and other non-absorbable suture material used at the time of operation for the radical cure of hernia. He added that any type of hernia that could not be cured without the use of silver wire or filigree had best be left without operation.

DR. CHARLES H. PECK said the question of tension was very important. In the overlapping operation one estimated the degree of tension and the strength of the edges by the sense of touch. It is important to dissect away weak tissues until we get a firm edge. A considerable degree of tension was unavoidable in the overlapping operation for large hernia, but if sutures are sufficient in number and carefully placed, tension did not prevent good healing and firm repair.

He used absorbable sutures almost exclusively: heavy chromicized catgut; one row of mattress sutures and two rows of supporting sutures. He thought the overlapping operation more successful than the edge-to-edge operation or the filigree. This method of Doctor Gibson's was a very valuable suggestion and might be of great assistance in many of these large ventral hernias.

#### INGUINAL HERNIA

DR. FRANZ TOREK read a paper with the above title.

## INGUINAL HERNIA

DR. WILLIAM B. COLEY stated that he thought Doctor Torek's paper should convince anyone that the idea so commonly held that the operation for hernia was a simple one, was fallacious. There are many fine points in the technic that play an important part in the success of the operation. In regard to Doctor Torek's particular technic, Doctor Coley thought he had given undue emphasis to the importance of separating the vas from the vessels of the cord in bringing them out through separate openings. Doctor Coley did not believe that this step played an important rôle nor did he agree with Doctor Torek about the hernial sac coming out between the vessels and the vas. Doctor Coley believed that anyone who has operated upon a large number of cases for the radical cure of hernia, especially in children, learns that the sac lies directly on top of the vessels and the vas which are spread out in a fan-like manner over the posterior wall of the sac. He has never seen a case in which the sac came out between the vessels and the vas, as described by Doctor Torek. Doctor Coley added that he always tied off the peritoneum high up beyond the neck of the sac without separating the vas from the cord, which method has given ideal results.

With regard to direct hernia, Doctor Coley had always transplanted the fascia of the rectus muscle or the rectus itself until very recently, when a new method occurred to him, and which he has used in three or four cases. Where one has a direct hernial sac he removes the same flush with the abdominal cavity. The transversalis fascia then remains wide open and this opening he treats precisely as anyone treats an umbilical hernia, according to the Mayo method of overlapping, in which the upper layer is brought underneath the lower, and then sutured to Poupart's ligament, after which the regular steps of the Bassini operation are carried out.

Doctor Coley wished to add one word about the sutures. He stated he was glad to know that Doctor Torek had abandoned silver wire with the exception of the two lower stitches of the deep layer, and he believed that in the near future Doctor Torek would abandon it altogether. He stated that, in his opinion, the absorbable suture was the only one that had any place in the hernial operation. Any suture that remains unabsorbed for a period of more than three or four weeks loses its tension and then remains as a foreign body. Doctor Coley has already pointed out the disadvantages of non-absorbable sutures so frequently that he did not think it necessary to repeat them on this occasion. He stated if one could see the after-results from the use of non-absorbable sutures, in the Out-Patient Department of the Hospital for Ruptured and Crippled, one would soon abandon their use.

DR. SETH M. MILLIKEN said he agreed with Doctor Torek's modification for the closure of the external ring. He had operated on a great many hernias referred by army and navy examining boards where there was no true sac, where there was a sac only on traction upon the cord, and in

these cases we find the vas behind the vessels and so close to them that it is impossible to tell from which side the sac comes.

DR. J. P. HOGUET asked Doctor Torek what per cent. of his cases were adults and what per cent. children, and whether he had seen most of these cases within the last few months.

As to direct hernia, it did not seem to him that this operation, whereby we make two weak points, is very rational. Naturally we must consider the question of recurrence and it is logical to believe that there will be more recurrences where there are two points with direct outside paths of emergence. The point at the internal ring external to the deep epigastric vessels, and also the point behind the external ring.

Doctor Torek does not fortify the external ring by allowing the vas to come out just external to the pubic spine, and that makes a weak spot, through which a direct recurrence would be very apt to come.

DR. LUCIUS W. HOTCHKISS said it was agreed that there was a great difference between hernias in adults and children. In children very often it was merely a question of the high ligation of the sac. In adults with a tendency to direct hernia one will find often a second sac to the inner side of the deep epigastric vessels. This is so common that overlooking it is one of the chief causes of so-called recurrence.

Another point to which he called attention was that there is sometimes a little piece of fat present that we take for a sac. He once ligated what appeared to be such a piece of fat and found that it was a diverticulum of the bladder.

This whole subject of hernia has been gone over very carefully in the camps and he thought that we must all revise our ideas and agree as to the necessity of doing a very careful operation. He thought Doctor Torek's points had been well taken and he had shown the need of great care in all operations for hernia.

DR. NATHAN W. GREEN said nineteen years ago, when he was an interne at St. Luke's Hospital, it was his good fortune to work with two attending surgeons, one of whom used non-absorbable sutures, and the other used absorbable sutures entirely. He saw only one case in which the non-absorbable sutures came out and that was due to infection.

He stated that he did not use non-absorbable suture material. He was surprised to hear Doctor Torek say that he used No. 3 chromic catgut. He himself never used at the present anything larger than No. 1. If he needed an additional strength he used No. 1 chromic catgut taken double.

In regard to the saddle-bag sac, one can convert the direct sac into an indirect sac by pushing the deep epigastric vessels toward the middle line while pulling the peritoneum outward. Then the sac can be closed by a running stitch as in any indirect hernia. Doctor Downes was one of the first whom he had seen use this method.

In making the muscular repair he makes his first stitch in the edge of the sheath of the rectus which he sews to the periosteum over the

## INGUINAL HERNIA

spine of the pubis. The external oblique he believes in closing so tightly that there is no chance of a subsequent examiner finding a large external ring and interpreting it as an incomplete repair.

DR. CHARLES H. PECK said that he did not agree with Doctor Torek about the separation of the vessels and the vas, nor upon the use of non-absorbable suture material, but he has paid much attention to a clean and careful technic and good apposition of tissues. He thought the paper could profitably be placed in the hands of every house surgeon.

Doctor Torek, in closing, stated, in regard to the relative position of the vessels, sac, and vas, that, of course, he referred to their relation at the internal ring. Outside the internal ring their relative position varies, but at the internal ring the anatomical arrangement is as stated in the paper. A dissection well down to the posterior surface of the transversalis fascia will convince one of the fact. That fan-shaped expansion which Doctor Coley referred to consists of connective tissue the presence of which conceals or blurs the actual relation of vas and vessels to the sac. In Doctor Torek's operation this connective tissue expansion is removed, and, if this is done, one will find the anatomical arrangement as he has described it.

As to whether he had seen these cases lately, he said that all the cases reported in this series had been seen within the last five months by himself or some other competent observer.

In regard to the percentage of cases in children and adults, he had almost no children in this series. That fact should be taken into consideration in comparing these statistics with those of a children's hospital, as in cases of children the result of a hernia operation is apt to be satisfactory no matter which one of the standard operations was performed.

As to the statement that he was making two weak points instead of one, he did not think one would claim this to be the case after inspecting the line of sutures. The vas takes up so little space where it emerges that the suture above it is just as close to the suture below it as any other two adjacent sutures.

As to the use of non-absorbable suture material, he said his opinion was shared by many good surgeons. However, he wished to lay emphasis on the use of non-absorbable material only where there was tension. In the absence of tension he does not insist on it. As the value of absorbable suture material had been mentioned in the discussion, he would like to relate a few experiences with chromic catgut. He had had occasion to operate on a patient on whom he had performed a laparotomy two years previously. Going in through the old scar he found a number of chromic catgut sutures which had been inserted two years before. He also mentioned that in his operation of orchidopexy for undescended testis he had always employed chromic catgut in attaching the testis to the fascia of the thigh; and when the testis was released six months later, in three cases he had found chromic catgut still unabsorbed. He said,

the label on the tube, stating that the gut is twenty or forty day catgut, is not to be relied upon—it may be two year catgut.

#### COMPARATIVE MERITS OF LANE PLATES AND INTRAMEDULLARY BONE SPLINTS

DR. JOSEPH WIENER presented röntgenograms of a boy ten years old, who was admitted to Mt. Sinai Hospital, April 29, 1918. He was thrown from his bicycle by a passing automobile and sustained a fracture of the lower end of the femur. On examination the left lower limb was found slightly abducted and the foot everted. There was a false point of motion about three inches from the knee. Buck's extension was applied. Shortening of limb persisted and X-ray showed that overriding continued.

On May 17, 1918, the boy was put on the Hawley table; a Steinman nail was inserted into the head of the tibia but traction failed to reduce the fracture. An incision was then made and an overriding fracture with soft callus was found. The callus was removed and a Lane plate introduced. Wound was closed without drainage and healed by first intention. The plate is still in place after eleven months. The boy is very active and has no symptoms whatever from the presence of the plate.

Doctor Wiener then presented radiographs of a patient, twenty-three years old, who was admitted January 13, 1916. Seventeen days before was struck in left arm by street car. When he recovered from the shock there was complete loss of function of the left arm, together with pain and swelling. The arm had been put up in splints with no attempt at reduction. His pain grew steadily worse until his admission to Mt. Sinai Hospital. On examination he found marked swelling and deformity at the lower third of left humerus. Flexion at elbow was possible but extension was impaired. Flexion angle  $60^{\circ}$ ; extension about  $20^{\circ}$ . Distal end of bone could be felt on inner side of arm.

*Operation* (January 17, 1916).—Intramedullary bone splint for ununited fracture of humerus. Five-inch incision on outer aspect of arm just above elbow. Fragments found displaced exactly as shown by röntgenograms. Ends of bone freed from muscles in which they were imbedded with great difficulty. About  $\frac{1}{4}$  inch was sawed off the end of each fragment. It was impossible to keep the fragments in apposition on account of flexion of lower fragment which was less than two inches long. A bone inlay  $2\frac{1}{2}$  inches long was taken from the tibia on same side with its periosteum attached. The medullary canal of both upper and lower fragments was scraped with a sharp spoon and with considerable difficulty the inlay was introduced. The ends of the inlay were denuded of periosteum. The periosteum which had been stripped from the fragments in freeing them was carefully sutured with chromic gut over the line of union. The remainder of wound was sutured without drainage. The wound healed by primary union. New bone rapidly formed and the ultimate result was functionally and cosmetically excellent.

## MYOMA OF THE SMALL INTESTINES

Doctor Wiener presented these röntgenograms for the purpose of inviting discussion as to the relative value of the Lane plate and the intramedullary splint. It has been his habit not to use the bone splint in difficult cases because it breaks. He had one case in which it took two members of the house staff, strong young men, to keep the femur in place. He put a Lane plate on the outside of the bone and another plate on the inside. The following day plate No. 1 on the outside had broken, but he obtained a good result because plate No. 2 held. He thought an intramedullary bone splint would certainly have been perfectly useless in that case.

*Stated Meeting held April 9, 1919*

The President, DR. CHARLES H. PECK, in the Chair

### MYOMA OF THE SMALL INTESTINES

DR. FRANK S. MATHEWS presented a woman forty-four years of age, two years past the menopause. She had come to his office several weeks before, complaining of mitral stenosis and stating that a hypogastric tumor had been noted quite recently. On examination, the tumor was found irregular, hypogastric and more to the left side. On bimanual examination the cyst ruptured. In a few minutes the patient's pulse became slow and weak, pain was severe and there was cold, clammy skin. She was taken to the hospital immediately and after a short application of external heat, she was taken to the operating room. He was expecting to find a ruptured cyst of pelvic origin, but was surprised to find that the cyst had no pelvic attachments and that the pelvic organs were normal. The abdomen contained considerable bloody fluid. The tumor had a small attachment to the side of the small intestine opposite the mesentery. It was cystic and solid and there were abundant evidences of previous hemorrhages into the mass. It was dissected from the bowel without resection, a small tear being made in the mucosa. Its origin was from the lower ileum, and possibly originated in a Meckels' diverticulum, as it lay entirely opposite the mesentery and was supplied with blood by two arteries from the mesentery which crossed the wall of the gut. The tumor proved to be a myoma of the smooth-cell variety. Before rupture of the cyst, the tumor would have measured seven or eight inches in diameter. Recovery was uneventful.

Doctor Mathews emphasized the infrequency of such myomata except in the uterus; he thought its probable origin to be at the site at which a Meckels' diverticulum is found; the rupture of the cyst from the trauma of very gentle manipulation, with immediately following severe symptoms, was also deserving of note.

DR. HERMANN FISCHER said that about eleven years ago he operated upon a fibro-lipoma of the stomach situated at the lesser curvature in a girl twenty years old. She complained of rather severe stomach symp-

toms without definite clinical findings pointing to a lesion of the stomach. On careful examination a small epigastric hernia was detected and held responsible for her distress. On operation the stomach was also inspected and to our surprise a tumor at the lesser curvature was found. A V-shaped resection was done. The mucous membrane was not involved, the seat of the tumor being the muscular wall. Microscopical examination showed the mass to be a fibro-myxo-fibroma with inflammatory changes.

Ten days after operation the patient developed a rather severe attack of tetany from which she, however, eventually recovered.

DR. JOHN A. HARTWELL said Doctor Rogers had a similar case of myoma of the lesser curvature. In that case the tumor was definitely myomatous, not pedunculated, and gave symptoms closely simulating those of gastric ulcer.

#### DOUBLE EMPYEMA—STREPTOCOCCUS HÆMOLYTICUS

DR. JOHN A. HARTWELL, for the purpose of introducing a discussion on the general topic of empyema, presented a young man who was admitted to the Medical Ward of Bellevue Hospital on December 16, 1918. He was transferred to the Surgical Ward eleven days later. He had a typical streptococcus pneumonia and consolidation of the right base, and there was evidence of fluid in the right pleural cavity. The patient was operated on by Doctor Dudley on the right side on the same day. The pleural cavity was opened through an incision in the right axillary line and a rib resected. A large amount of thick purulent fluid was evacuated which toward the last became blood stained. It gave a pure culture of streptococcus hæmolyticus. Carrel tubes were inserted and Dakin's solution used until the discharge became almost like pure blood, then this was discontinued. The patient progressed favorably though slowly for about three weeks and then became desperately sick, owing to his continued general infection with the streptococcus. The discharge became less and he was gradually gaining when he developed empyema on the left side. Three radiographs showed that the empyema had localized in the lower portion of the left chest. A second operation was performed on February 3, six weeks after the first, a rib resection similar to the first being done. On this side the ordinary method of drainage was employed and there was no washing or any other method of local treatment; the use of blow-bottles and calisthenics was begun early and seriously carried out. Both sides healed up and the man went to the Burke Foundation. He has recently returned and physical examination showed no abnormality. Radiographs showed both lungs fully expanded. He was a completely healed and cured case of double streptococcus empyema.

His only reason for showing the case was that one has here a case in which there was empyema on both sides; on one side Dakin's solution

was used and not on the other. The side on which the Dakin's solution was used did not heal up any more promptly than the other side treated with the old-fashioned simple drainage. They have been running a series of cases, one-half with incision and simple drainage and the other half treated with Dakin's solution through Carrel tubes in addition to complete drainage, putting the tubes in at the time of the operation or twenty-four to forty-eight hours afterward. In the pneumococcus empyemas he thought this treatment was beneficial, where the pus is thick, but in cases of the hæmolytic type he does not feel that it does much good. With the use of Dakin's solution the time of healing was not shortened as compared with the average cases in which Dakin's solution was not used. With Dakin's solution, however, there was less tendency for the cases to continue longer than the average time and there was a more uniform result with the Dakin treatment. The question of treatment rests very largely on the type of disease with which the surgeon is dealing. In many cases the empyema is only an expression of a general infection, and if one operates early one still deals with a general streptococcus condition and one does not accomplish much. This case was presented to focus attention on the fact that the old method of treating empyema gives exceedingly good results, if the details of ample drainage and careful after-treatment are carried out. In contrast, however, there was at present on the service a case of pneumococcus empyema handled in the same way which was still unhealed after more than ten weeks. A complicating factor, however, existed in the fact that at the time of the first operation an open communication via the lung was present between the bronchi and the pleura. So far as can be determined this has closed but it interfered with the orderly course of events at first. Thus illustrating that in all discussions on the treatment of empyema a strict interpretation of the lesions must be kept in mind.

DR. HOWARD LILIENHAL said if one has a unilocular empyema not complicated with a bronchiectasis or a lung abscess it may heal in one of two ways. It may heal from the outside with sterile pus within, the lung gradually becoming distended until in time it reaches the costal pleura, or it may heal with the gradual formation of adhesions all around the lung, coincidentally reaching the costal pleura. If it does not heal in one of these two ways it will remain open with a sinus. If one should fluoroscope such a case and the lung does not move pretty distinctly one will probably be obliged to operate unless complete asepsis can be secured. We have tried various methods of disinfection and it does not make much difference what method one uses. In an empyema thus closed accidents may happen. A serious accident is the slow perforation into a bronchus, and one would not know that this has happened until the patient coughs up and one then has the additional complication of a bronchial fistula.

He has X-rays of the chest of a young girl who had a sinus that opened and closed periodically. The X-ray showed an almost complete

pyo-pneumothorax and a great space in the lung compressed. The girl looked well and he thought he would see what could be done for her without operation, so he sent her to the country and told her mother that if the sinus opened again he would operate. Nearly a year after the girl returned and the X-rays taken at that time showed both sides so nearly alike that it was difficult to say which side had been affected.

It is not absolutely necessary to have the lung in complete adhesion with the chest wall in order to have an absolute cure. It is possible in unilocular empyemas to have cures with the Carrel-Dakin treatment if one is sure one is dealing with a unilocular empyema, but in that child he was unable to use the fluoroscope because the thorax was closed and if the thorax is closed the lung cannot obliterate the pneumothorax. He has been trying to make up his mind which cases were suitable for operation but has not quite decided whether or not it was wise to let the wound heal, provided, of course, the empyema was a unilocular one.

DR. JAMES I. RUSSELL said he recently had a case of empyema on both sides in a child ten years old. She was so ill that it was a question whether best to treat her by aspiration or by drainage; and whether, if establishing drainage, which side, or whether both sides of the chest should be opened simultaneously. Aspiration was first tried, but she continued to grow more septic. The rib was resected on the right side under nitrous oxide, and a few days later the left was similarly treated. Dakin's solution was used in this case with apparent good result.

In the use of Dakin's solution he has seen an interesting series of cases, some that were still unhealed from the 1917 epidemic, and the more recent ones that followed the influenza epidemic last fall. He does not think that it has any specific action other than as a solvent; and when there is the thick tenacious discharge, it is certainly very valuable. Patients frequently complained of the taste of chlorine when the wound was irrigated, which was undoubtedly due to the entrance of the fluid into the small pin-point perforations of the lung which are often overlooked in empyema.

From the study of X-ray plates he felt sure that empyema was not always a single abscess cavity, but was frequently loculated or multiple cavities formed just as peritoneal abscesses, from a general peritonitis.

DR. LILIENTHAL called attention to the fact that empyema was not usually unilocular; there are very frequently pockets, often minute ones. He thought such abscesses were less likely to go undiscovered. If the main cavity is opened early by a minor operation to give an exit for the pus, then a few days later after X-ray study one can operate as indicated by the condition. One can do this through an intercostal space, without the resection of one or more ribs, by making an intercostal incision and separating the ribs by strong rib retractors. One should bear in mind the fact that one may have a number of empyema abscesses in one patient. He recalls one instance in which the patient had four

## CARCINOMA OF THE RECTUM

abscesses, one at the apex, one at the outer side of the lung, one in an intercostal space and one in the lower lobe. Smaller abscesses are often likely to break into a bronchus than into the main cavity.

DOCTOR PECK said he has a prejudice against open pneumothorax. He thought a great deal can be accomplished by air-tight drainage, if the drainage is early and adequate. Too often the ordinary surgical principles of drainage are not carried out intelligently. If one gets a good air-tight drainage in these cases and then leaves them alone for eight or nine days, beginning the use of blow bottles at once, very good results are obtained without the use of Dakin's solution, and there is little soiling of the primary dressing which may often be left without changing until the tube is removed. He has had a number of cases in which this principle was carried out. After the drainage tube was in eight or nine days, in many of these cases the pleural cavity was almost closed and there was complete healing in five or six weeks. Of course this does not happen in every case but it does in many. The trouble often is that ordinary drainage is not properly carried out and this is the reason one sometimes later has a thickened pleura and persistent cavities. As the wound gets older the rate of healing diminishes.

## RHINOPLASTY FOR CARCINOMA OF THE NOSE

DR. FRANZ TOREK presented a patient with carcinoma of the nose. The case was one of a large fungating tumor requiring the removal of the greater part of the nose and septum. The object of this presentation was to show that a fairly satisfactory result could be obtained by a rather simple plastic operation. There was no implantation of bone or cartilage and yet the skin flap taken from the forehead showed a remarkable degree of firmness, scarcely distinguished from that of cartilage, although it had no support from the septum. The flap had been made long enough to be doubled on itself, thus providing an inside lining of skin, the two layers of skin being attached to each other by a couple of mattress sutures. The reduplication of the flap, it appears, was accountable for its firmness, while at the same time it provided a well finished margin. The outer border of the ala showed a particularly happy imitation of the normal.

## CARCINOMA OF THE RECTUM—COMBINED ABDOMINO-SACRAL OPERATION

DR. FRANZ TOREK presented two patients in which a combined abdomino-sacral operation had been performed, and no artificial anus made, and still the patients have the control of a normal anus and the result of the operation was perfectly satisfactory in both cases.

He showed a case and described the operation in the ANNALS OF SURGERY of November, 1917. Briefly the operation consisted in an abdominal portion and a sacral portion. The abdominal operation consisted in the mobilization of the sigmoid, loosening it and the pelvic colon

and rectum down to the pelvic floor. The important point in this part of the operation was to mobilize without endangering the blood supply. The inferior mesenteric usually has three sigmoid branches, the lowest being given off when the inferior mesenteric becomes the superior hemorrhoidal. The latter divides into several small terminal branches which anastomose very imperfectly with the branches of the sigmoid artery. To mobilize the sigmoid flexure, therefore, the inferior mesenteric must be divided above the point where the lowest sigmoid branch is given off in order to provide for a sufficient blood supply to the pelvic colon and rectum, the supply running through the lowest sigmoid in a backward direction to its origin, thence down through the superior hemorrhoidal. The point of ligation is about an inch above the insertion of the peritoneal fold at the promontory of the sacrum. The sigmoid flexure, pelvic colon, and rectum are liberated and pushed well down into the pelvis, ready to be attached in the subsequent part of the operation. An incision is then made along the side of the coccyx to the lower part of the sacrum and the rectum mobilized and invaginated or rather evaginated through the well-stretched sphincter, and then amputated at the anus and above the tumor, the upper segment being sewn to the anus. The really important point is in regard to the blood supply, as he has explained in his published article. The third sigmoid artery is the one that gives the blood supply, and one must not cut the superior hemorrhoidal below the point where the last sigmoid artery is given off, for if one does, the anastomosis is imperfect, and one may get gangrene.

In this first case a scar had formed in the rectum which looked as though it might be a stricture. This helped the patient to control the escape of fæces. She takes an enema every day and is very comfortable.

The second case is a duplicate of the first, differing in one point only. He advised this patient against operation because the carcinoma was so low that he feared a radical resection could not be done without taking away the whole sphincter, but the patient insisted on an operation without artificial anus and persuaded him to try it. In this he cut through the sphincter and laid it back, dissecting the rectum from it, after which the affected portion of the bowel was amputated. After suturing the cut end of the bowel to the anus, he then resutured the sphincter where it had been divided, although he thought there would not be sufficient innervation to give the patient any use of the sphincter. He had, however, some sphincteric action and had no inconvenience from his stools. He takes an enema once a day and sometimes skips a day. One always fears the inconvenience of escaping fæces when one divides the sphincter, but there has been no such inconvenience in this case.

DR. JOHN A. HARTWELL said in examining these patients of Doctor Torek his impression was that the man has carcinoma at the present time and he thought the woman also. She has a dense cicatricial point that seems as though it were a recurrence.

## CARCINOMA OF THE RECTUM

A number of years ago he collected cases operated upon by the sacral method without an inguinal colostomy by seventeen surgeons and practically all had local recurrences within two or three years, and in many instances the recurrence was very prompt. He asked Doctor Bull to look over his paper and he said it was a good piece of work but that Doctor Hartwell had wasted a great deal of ammunition in demonstrating a self-evident fact, etc. One could not expect to cure a carcinoma of the rectum in that way, as there was not a wide enough incision below the growth where any attempt to save the anal margin was made. He recognized that recurrence was very frequent in all cases of carcinoma of the rectum, but there was always a local recurrence after the method under discussion.

DR. WILLIAM LUSK said that the implantation of the freed proximal sigmoid extremity of the gut into an intact anal canal was very likely to be followed by gangrene of the implanted segment.

DR. HOWARD LILIENTHAL said as to the operation suitable for carcinoma of the rectum he thought it was a matter of the artistic choice of the surgeon. He believed that in small sized cicatricial carcinoma, well localized and situated in the right locality for that procedure, it was the best operation that could be done. He reported a case a year ago before the American Surgical Association in which he did the operation a little differently than the one done by Doctor Torek. He made his abdominal incision and loosened the sigmoid. The carcinoma was situated at the rectosigmoid junction. He passed in a probe carrying a silk ligature. Then by stretching the anus he pulled the whole tumor-bearing region out of the rectum and managed to do a wide excision. The man recovered and when he left for France he was perfectly well. He has seen him since his return and he is still perfectly well and has no sign of recurrence. That was a case in which he decided what he would do after he had explored it from the abdominal side. The tumor was small and admirably placed for this kind of an operation. This man has no sign of a stricture. There is perfect function.

DR. WILLY MEYER said that if one preserves only one or one and one-half inches of the rectum with the sphincteric portion, one must look for a recurrence. He thinks the majority of surgeons agree that one must sacrifice the sphincteric portion in order to get radically rid of tumor. For a constricting tumor he considers cæcostomy through a McBurney incision a good method, as the first step in a two-stage operation. But it is not necessary to establish an artificial anus in every advanced case. The degree of constriction decides. Several days of preparation are then required. After amputation a sacral anus is established or the lower end stitched about one inch below the surface of the skin of the perineal wound. He had one patient thus operated upon about eight years ago. With an enema in the morning he keeps himself com-

fortable and clean for days. Twisting of the stump before suturing, after Gersung, offers additional advantages.

DR. CHARLES H. PECK stated that he had a case of this kind done about ten days ago and he had seldom done the operation under more favorable circumstances. This patient had a long lax sigmoid and he did practically the operation Doctor Torek has described. He would like to say that in that case he does not see how the danger of recurrence can be greater than in other methods. The bowel was divided at least three inches above the growth, the upper rectum and mesosigmoid were mobilized and the entire hollow of the sacrum cleaned out. The entire anal mucous membrane was removed and the sphincter split behind. The end of the sigmoid was brought down on a level with the skin edge. He thought with this procedure there is no added danger of stricture and that the only question was that of recurrence and that was a question of going high enough above the growth to avoid a recurrence in the proximal segment. The cases in which this procedure can be safely done are few.

DOCTOR HARTWELL said he thought it was in the lower segment that there is the greatest danger of recurrence.

These cases are apt to recur below the point of resection when an attempt is made to leave an inferior functioning segment. There is not room enough between the anus and the growth to make it worth while to attempt to save the anal outlet, if one is certain all infected tissue is removed.

DOCTOR PECK said that two or two and one-half inches of the gut below the growth was removed with the entire anal mucous membrane. He did not expect to get a great deal of sphincteric action. He thought if he took away all the tissue that it would be an advantage to remove. This type of resection is only suitable when the growth is high enough up to allow for a good clearance.

DOCTOR TOREK, in closing, said all three cases had strictures and these strictures instead of being a drawback have been a comfort for they hold the contents of the bowel sufficiently well to have the effect of a sphincter and then by the simple method of taking an enema once a day the bowel is cleaned out completely. You see a stricture has formed in every one of these cases. He shall not hesitate to do the operation where the entire sphincter has to be removed. The operation may be done just as radically by this method as by any other, and there is no question that the combined operation has many advantages over the operations done from below only, because when one opens the abdomen and finds metastases in the liver or in the peritoneum he knows there is no use of attempting a radical operation. By doing the abdominal operation first, one at once can draw the line between cases that are operable and those that are inoperable.

As to sloughs he always feels quite positive that they are caused by

#### RARE PATHOGNOMIC SYMPTOM OF CHOLECYSTITIS

drawing the gut through the sphincter because the sphincter is widely stretched. If there should be sloughing it would be from interference with the blood supply and not from constriction by the sphincter.

#### CARCINOMA OF THE TONGUE—COMPLETE EXTIRPATION

DR. FRANZ TOREK presented a patient who was operated on three years and four months ago for carcinoma of the tongue and presents several points of interest. Examination shows that there is no trace of tongue to be seen. The floor of the mouth was removed at the same time. This threw the hyoid bone forward and one can see the epiglottis. The second point of interest is that the two halves of the lower jaw are drawn toward each other. Of course, all the lymphatic nodes were removed all along the sternocleidomastoid and the submaxillary nodes. He did a Kocher's operation with the division of the jaw in the middle. The two portions were not in proper alignment and overlap in the middle, owing to necrosis at the sawed surface and scar contracture at the floor of the mouth. The third point is that this patient speaks very well, even such consonants as s and l and he has a very good cosmetic result. He was operated on December 29, 1915. It was interesting to see how a person with absolutely no trace of tongue could learn to speak and do without such an important organ. The fourth point was that of a late recurrence, three years and three months after the operation in a node above the outer end of the clavicle which he removed recently. He has no evidence of recurrence in the mouth, nor in the submaxillary and sternocleidomastoid regions. When he was first seen by Doctor Torek, the floor of the mouth and both sides of the tongue were involved along the edges. If only one edge had been involved he would have removed only one-half of the tongue. It was a case in which there was very little hope of keeping the man alive as long as he has now lived.

#### RARE PATHOGNOMIC SYMPTOM OF CHOLECYSTITIS— CHOLECYSTECTOMY

DR. WILLY MEYER presented a patient because she presented a rare pathognomic symptom of chronic cholecystitis. She was an Italian, thirty-three years of age, who had had for quite a number of years attacks of pain, always on the left side of the upper abdomen corresponding to the costal arch, and radiating down to the left of the abdomen. Also to the back and left shoulder, but never to the right and never toward the liver. He had seen patients with similar symptoms at his office, in whom he could not ascertain what the trouble was. He had thought of ulcer of the lesser curvature, chronic pancreatitis, or a kidney lesion, but could not make the diagnosis; they refused admission to the hospital and drifted away from him. This patient came with such a distinct record of attacks reminding him of chronic cholecystitis. She was sent to the hospital for laboratory examination. All the usual ex-

aminations were made, except that of the duodenal contents. While in the hospital she had pain for the first time that was radiated from left to right.

At operation the gall-bladder, filled with stones, was found low beneath the liver so that it could not have been palpated. Perthes' incision was employed. The skin incision may look large but the real abdominal incision is comparatively small. The speaker stated he had used this incision about thirty-five to forty times and the oftener he did it the better he liked it. It gives ample space for exploration of the intra-abdominal organs enabling one also to explore and remove the appendix. It is especially suitable for giving access to the lower aspect of the liver. He had used it in all kinds of operations on gall-bladder and ducts, also in one case of periduodenal abscess. There is never a sign of ventral hernia later.

The examination of the duodenal contents is a very welcome addition to our diagnostic resources. The X-ray fails in many cases to give sufficient pathognomic signs of gall-bladder disease. Some have claimed that the diagnosis of cholelithiasis can be made in 30, 50 and even 80 per cent. of the cases, but he thinks the rays can make a positive diagnosis in only 15 or 20 per cent.

Examination of the duodenal contents may show the presence of pus corpuscles, cholestearin, putrid bile, etc. During operation the gall-bladder is aspirated and the color of the bile obtained compared with that found in the duodenal contents. One will find that it almost invariably corresponds and hence the examination of the duodenal contents gives a good idea of the real condition of the bile. The particular point desired to be brought out in this patient was that if a patient comes with paroxysmal pains in the extreme left side and the same runs to the back and also to the left shoulder, one has also to think of cholecystitis. Patients with cholangitis are always jaundiced, though sometimes but slightly, but those with cholecystitis that he had been talking about are not jaundiced; they are discharging their bile physiologically into the abdomen and if one examines the duodenal contents one can get points on the diagnosis that are of value.

#### LOTHEISEN OPERATION FOR FEMORAL HERNIA

DR. HERMANN FISCHER read a paper with the above title, for which see p. 432.

Doctor Fischer presented three cases for the purpose of illustrating his paper. The results in all three are good. If the patients are examined in the erect posture and made to strain, one will notice that at the point of the operation there is a distinct inward pull of the abdominal musculature instead of the usual bulging outward.

DR. WILLY MEYER said the operation described by Doctor Fischer is very similar to the operation proposed by Fabricius, of Vienna, in 1894. The latter also makes an oblique incision, but, instead of one-quarter of

## LOTHEISEN OPERATION FOR FEMORAL HERNIA

an inch above Poupart's ligament, one-quarter of an inch below the same. Poupart's ligament is exposed, the hernia properly attended to, and the crural ring thoroughly cleared of its contents. One then tries to bring the ligament down to the tissues to the inside of and next to the vessels. The femoral vein is exposed and pulled outward. A well-curved needle is introduced down to the pubic bone; one tries to catch its periosteum stitches the pectineus muscle to Poupart's ligament. The space next to Gimbernat's ligament is entirely obliterated. The first outer suture must be carefully placed to avoid compression of the vein. This operation of Fabricius can also be highly recommended. The speaker has repeatedly brought patients thus operated on before the society.

DOCTOR TOREK said the operation of Fabricius was surely not identical with the Lotheisen operation. Fabricius brought Poupart's ligament down to the pectineus muscle while Lotheisen brings the internal oblique into contact with Cooper's ligament. The Lotheisen operation has been his choice ever since it was published. It was technically somewhat difficult to gain access to Cooper's ligament, since it was rather deep. In his first case of this operation he cut through Poupart's ligament in order to gain better access to Cooper's ligament, and then he sewed up Poupart's ligament again. He found that it was unnecessary to cut through Poupart's ligament, and that the suture was feasible with fair ease if a properly curved needle was employed. One must carefully guard the femoral vein. It was always best to lay it bare and draw it aside to a certain extent but never so far as to compress it.

DOCTOR FISCHER said, in answer to Doctor Meyer's remarks, that the Fabricius operation and the Lotheisen are not the same, but differ radically from each other. Fabricius closes the femoral ring by uniting Poupart's ligament to Cooper's ligament, similar to the Moschcowitz-Frank operation. In Lotheisen's operation the conjoined tendon is sewed to Cooper's ligament; Poupart's ligament is not at all used for the plastic closure of the femoral ring. The Lotheisen operation is especially useful in large and strangulated or irreducible femoral hernias in which one is compelled to divide Poupart's ligament. Of course, it is a well-known fact that a femoral hernia is often cured by the simple Bassini operation, but these are uncomplicated cases of small size, the large complicated ones easily recur. In the Lotheisen operation the sac is also tied off as high as possible.

DR. NATHAN W. GREEN said he had done a number of femoral hernia operations according to the Ruggi method which in some respects is similar to the Lotheisen. It seemed to him the operation was excellent but more elaborate than the simple high ligation of the neck of the sac with stitching the posterior part of Poupart's ligament to the pectineal fascia. He said he generally took two stitches at this point, then if one gave way the other still held. He thought this a simpler way of repairing femoral herniæ and it appeared quite adequate as they seldom recurred after this ordinary procedure.

## BOOK REVIEWS

**SURGICAL ASPECTS OF TYPHOID AND PARATYPHOID FEVERS.** By A. E. WEBB-JOHNSON, D.S.O., Consulting Surgeon British Expeditionary Force, Hunterian Professor of Surgery, R.V.S.E. London, Oxford. University Press, 1919, octavo, cloth, pages 190.

This is an amplification and revision of the Hunterian Lecture for 1917. The Director General of the British Army Medical Service, Lieut.-Gen. T. H. Goodwin, opens the book with the remark that, with the exception of Keen's book, written in 1898, comparatively little literature has been contributed to the subject on the surgical complications and sequelæ of typhoid fever, notwithstanding that perhaps as an influence upon armies in the field it is probable that typhoid and paratyphoid fevers have had a greater part than any other group of diseases. The author himself in his own preface states that, although twenty years have elapsed since the publication of Keen's book, it was dealt with so thoroughly by that surgeon that all that was called for at the present time was a consideration of new problems, with a review of advances in our knowledge consistent with our present conception of these fevers and with modern surgical practice. The book was compiled under war conditions and was primarily intended for the information and use of the surgeons of the British forces in the field.

The author is evidently interested in the history of medicine and medical biography, as shown by the very attractive historical sketch which constitutes Chapter I of the book, which is illustrated by many portraits of surgeons who have made important contributions in the past to our knowledge of typhoid fever, beginning with Thomas Willis, who was serving King Charles I in the Cromwellian Wars when the Royalist forces, as well as the parliamentary troops, were both alike decimated by an outbreak of disease which was described in detail in Willis's work "*De Febribus*" so fully as to leave no doubt that the fever which prevailed was typhoid. In the next generation, the eldest son of James I, Prince Henry of Wales, died of typhoid fever and an excellent and rare portrait of that prince is given, followed by that of his physician, Sir Theodore de Mayerne, whose account of the prince's illness and the description of the appearances found at post-mortem are so full and accurate that there is no difficulty now in recognizing that the illness was typhoid fever. The death of Prince Albert from typhoid fever does not escape mention, which mention is accompanied by a portrait of Sir William Jenner, who attended Prince Albert in that illness and also in the illness of his son, the Prince of Wales, who afterwards became better

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known to history as King Edward the Sixth, who nearly died from the same disease ten years after the death of his father.

Perhaps the most interesting of the portraits given in this historical sketch is that of William Clift, since the medical public is not so familiar with this portrait as it is with those of his better known superiors, John Hunter and Matthew Baillie. The last two portraits in the chapter are, respectively, those of Sir James Paget and of William W. Keen.

The association of these personal sketches in this historical chapter constitutes a peculiar attraction to the book and alone should suffice to make it popular.

The text of that portion of the book devoted to the special theme is comparatively brief. Of especial interest is the tabulated statement in which are given 103 causes of death due to surgical complication of typhoid and paratyphoid fever in 2500 cases of these diseases. The mortality attending the paratyphoid types (A and B) is almost negligible. The difference between the mortality following typhoid of spontaneous origin and typhoid produced by direct inoculation is very marked, spontaneous typhoid having a mortality of 19.19 per cent., and that of the inoculated form only 3.28 per cent. of the fatal results. Of the 103 deaths 67 were due to hemorrhage; 14 to perforation. Of other surgical complications not necessarily fatal, the most frequent was venous thrombosis, 42 cases of which are here recorded. Many negative complications appear in the list, such as 37 cases of tonsillitis; 17 cases of laryngitis; 15 cases of cholecystitis; 11 cases of appendicitis; 3 cases of abscess of the spleen; 2 cases of abscess of the liver; 3 cases of abscess of the lung; 2 cases of empyema; 22 cases of other abscesses.

In the subsequent chapters the author takes up in succession the lesions, first of the alimentary tract, then of the spleen, then of the liver, biliary passages and pancreas.

The chapter devoted to the cardiovascular system is one of the most important of the series, as is evident from the large proportion of thromboses in the tabulated statement. Thrombosis plays a part in the origin of bedsores and in cases of gangrene about the face and external genitals.

Gangrene of an extremity is a well-known though rare complication. Excluding bedsores, the legs and neck suffered from gangrene more frequently than all other parts of the body put together, with equal frequency upon the two sides.

Venous thrombosis, even though it may not call for so serious an intervention as amputation, may lead to serious disability. Not only is convalescence prolonged, but the circulation in the limb may be permanently damaged. Varix may develop or there may be such a persistency of œdema as to cause permanent weakness and disability of the

limb. In case of obstruction of the external iliac vein there may develop in the abdominal wall large and tortuous veins in the effort to compensate the obstruction of the venous return from the lower extremity. The incidence of venous thrombosis is commonest in typhoid, is fairly frequent in paratyphoid A, least frequent in paratyphoid B. The femoral vein is the one most commonly affected and in the present series there are 25, 10 in the leg, 5 in the iliac, 4 in the popliteal, and 3 in the internal saphenous vein. There was no case of thrombosis in the upper limb, though this may occur. The left lower limb was affected in the majority of cases, a preponderant frequency referred by Keen to the obstruction to the return of venous blood by the compression of the left common iliac vein where it passes under the right common iliac artery.

Of the present series which suffered thrombosis, only one died, death being due to the toxæmia of the disease, although the thrombosis was not entirely free from agency in contributing to the fatal result, the post-mortem showing present many infarcts in the heart, lungs and kidneys.

With regard to the effects of the typhoid bacilli upon the urinary system. In a large number of cases the bacilli appear in the urine in typhoid proper, in about one-fourth of the cases; in paratyphoid, a proportion much less. Albuminuria to a more or less degree occurs in 60 per cent. of all cases. Pyelitis and cystitis were definitely diagnosed in a small group of cases. They yielded rapidly to treatment, urinary antiseptics in the series studied by the author. No case of kidney complication required local surgical treatment.

Parotitis is a serious complication. It is fortunately rare, in the present series of cases having occurred only in about one-third of 1 per cent. of the cases. Two of these cases were fatal. With one exception all of the cases of this series were unilateral. The gland was incised in 6 of the 9 cases, but in two of them no pus was found, a not uncommon experience in cases of secondary parotitis. Nevertheless, in view of the dangers of the condition, incision should be made without waiting for fluctuation, when the swelling increases or the œdema appears. The author is of opinion that present evidence warrants the conclusion that the parotid is infected by extension from the mouth through the parotid duct.

Bone and joint complications receive full treatment.

The book as a whole is an interesting résumé of present knowledge with regard to the surgical aspects of typhoid and paratyphoid fevers. It belongs to the class of war medical and surgical tracts, the large number of which bears testimony to the activity and earnestness of efforts to secure the highest possible degree of efficiency in bringing surgical relief to the soldiers of the allied forces during the recent war.

## BOOK REVIEW

THE AFTER-TREATMENT OF WOUNDS AND INJURIES. By R. C. ELMSLIE, M.S., F.R.C.S. Philadelphia, Pa. Blakiston Son & Co. Cloth; octavo; pages 323.

The title of this book is not fully descriptive of its field. The Treatment of the Late Results of Wounds and Injuries is, perhaps, more descriptive of the real contents of the book. It cannot be classed as a book on Orthopedic Surgery, although discussion of the treatment of deformities is an important part of it.

After some discussion of the principles of reparative surgery, the author discusses the treatment of chronic osteomyelitis, stating that chronic sinuses of bone are, perhaps, the most frequent sequels of a wound and, in most, important causes of delay in reparative work. In cases of this condition he follows the radical methods advocated by Broca, which he reports in his hands to have been most successful.

In cases of sinuses leading to bone, he says the incisions must be made of sufficient length to enable the bone to be exposed above and below the injured site, even if this necessitates an incision 10 or 12 inches long. The periosteum must be stripped back from the whole circumference of the bone. Every track and cavity in the bone must be thoroughly explored and every tunnel and every cavity must be scraped and chiseled until it lies flat and no longer makes a groove and there remains behind only healthy bone or callus. If, however, the cavity is of such depth that it can not be laid quite flat without endangering the strength of the bone, it may be converted into a gutter into which the soft tissues can fall. Though the extensive removal of bone in these radical procedures may appear to endanger the shaft of the bone, no hesitation should interfere with its performance.

*Ununited fractures* next come under consideration and are treated fully and most satisfactory in Chapters III and IV. This involves the subject of bone graft to which especial paragraphs are devoted. Stiff joints and flail joints follow, and then the results of injuries of nerves and the surgical treatment indicated.

Amputations are considered from the standpoint of the best functional results and the adaptability of the stumps to prosthetic appliances. Various considerations involved in the repair of wounds of the upper limb, and then of the lower limb, are fully treated and form an important and interesting part of the book. Paragraphs are then devoted to splints and surgical appliances and to plaster-of-Paris. The volume is closed by a chapter devoted to such matters as baths, massage, passive movements, radium, X-ray, etc.

This brief résumé of its contents shows how important are the subjects which are treated, all having a particular bearing upon the possibilities of restoration to some activity to wounded men. The subjects are well treated, and fully described. The book is fully illustrated.

## BOOK REVIEWS

LICE AND THEIR MENACE TO MAN. By LIEUT. L. LLOYD, R.A.M.C., Entomologist in Northern Rhodesia. With a Chapter on Trench Fever by MAJOR W. BYAM. London. Oxford University Press, 1919. Octavo; pages 136; cloth.

This book is a by-product of the war. Although lice have always existed, it is only the special multiplication under army conditions which has made them such a pest and such a menace to man as to make possible and popular the devotion of a book to their consideration. Notwithstanding this book is intended for the general reader rather than for the specialist, it is probable that all surgeons will belong sufficiently to the first class to make the book of interest to them, for it is not likely that the number of entomologists as specialists is so great as to count for much in the number of the readers which this book ought to have.

The louse has been the subject of intensive study to entomologists during the past few years, and certainly that which we have learned with regard to it warrants the statement that one of the most urgent sanitary problems of the future is the destruction and prevention of lice. Individual effort and organized public instruction should work together in disseminating knowledge of the dangers of this pest and of the methods in which it should be corrected and controlled. The author justly remarks in his preface that since it has been shown that many insects play an important part in the spread of diseases, it would be strange if the louse which shares our clothes, lives on such intimate terms with us, should not be incriminated. Recently acquired knowledge has shown that it must be ranked with mosquitoes and rat fleas in its malign influences. Typhus, one of the most dreaded diseases of man, is entirely due to its activities. Relapsing fever is caused by its spread and its labors, and the recent war has developed a new disease, trench fever, which must be referred to its discredit.

There are three species of lice which are found upon man, the head louse (*Pediculus capitis*), the body or clothes louse (*Pediculus corporis, seu vestimenti*), and the crab louse (*Phthirus pubis*).

Before the war the head louse was the only one with which the average person in this country was acquainted, as the pest occurring most frequently in children who became infected with them occasionally from conditions attending even the best regulated schools. The body louse in ordinary life was almost unknown, in the United States, at least. The stories passed down from our veteran troops in the relation of their Civil War experiences contained traditions of its prevalence and annoyance, especially in prison camps. In mediæval times, however, it was much more widely distributed, so that every one, from the highest to the lowest, was familiar with the pest, indeed, it was accounted a special virtue of certain saints that lice swarmed upon them and it was an ostentatious manifestation of their humility that they considered themselves unworthy to kill even so disgusting a product of creation as a louse.

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Lice breed from pre-existing lice. However unclean in habit a person may be, unless he come in contact with one who is lousy or picks up a louse and is infected with one, he cannot become infested with them.

The louse propagates itself by eggs which are laid at the rate of 8 to 10 a day, and the egg-producing period continues for from twenty-five to thirty days, so that each pair of lice produce about 300 offspring of the first generation and many of these will have started to breed before their parents die, so that a female louse under conditions ideal from the louse's point of view might have about 4000 offspring before she dies. The average life of a louse, unless accidentally cut short, is from forty to forty-five days. As the days advance with her she becomes thin and anæmic, she ceases to breed or feed, continues for some days in a condition of senile lethargy and then gives up the ghost.

Lice are transmitted from person to person by contact, and especially by contact with infested clothing, body clothing, but more especially bed clothing. Cases are on record where single garments have held thousands of lice. Excluding such extreme cases the authorities tell us that of the men who have lice upon them, about 95 per cent. of them would have upon an average 20 to a man. The extreme, however, is in one case in which upon one shirt there were found 10,428 lice and 10,253 eggs.

Body lice, then, are found on men all over the world and there is probably no tribe free from them. They are, however, less prevalent in tropical than in temperate and cold climates, and in temperate climates they are less numerous in summer than in winter; these facts being correlated with the different habits of people in winter. In winter time people wear clothing of wool which is preferred by lice and such woollen garments are changed less frequently and people keep more indoors and crowd together, all of which conditions tend to favor the increase of lice whose life activities are best carried on at the body temperature.

One who is curious as to the life history and the habits of the louse will find much to interest him in this little book. The chapters which are given to the relations of the louse to relapsing fever and to typhus fever are of special importance and interest, especially as they show how perfectly possible by ordinary and simple hygienic measures it is to control the spread of these fevers which have been productive of such extensive fatal epidemics in the past.

One of the worst indictments of the medical service of the German army will ever be the sad story of the Wittenberg Prisoners Camp, where, owing to contact with Russian prisoners, typhus broke out among the imprisoned allies. At once all the German staff, both administrative and medical, abandoned the camp. The authorities cut off all necessary sanitary supplies and forbade any communication between the people outside and the unfortunate prisoners. The medical officer in charge, a certain Doctor Aschenbach (let his name ever hereafter be associated with that of Wirz of Andersonville ill fame), visited the camp only once during

## BOOK REVIEWS

the six months that the epidemic raged. Over 300 out of 800 prisoners who contracted the complaint died, and among them six medical officers of the British service, who were left unaided without supplies of any kind to grapple with the disease that prevailed about them. The Germans knew, as the world knew, that typhus was spread by lice and that the epidemic could have been cut short and stamped out a week after its commencement, by disinfection of all the prisoners, a procedure which the prisoners themselves would most willingly have performed had the necessary apparatus been provided; and when an appeal was made for such apparatus, they received in return simply an insult.

As to trench fever, it has been proved beyond doubt that lice are responsible for carrying the disease from man to man. It was not necessary, however, for a man to have been in the trenches in order to have contracted the fever. It was simply necessary that he should have been the subject of lice infection, the louse acting as a carrier of the germ in the blood of one sick man to the blood of the healthy man who was to become thereby infected. The preliminary work by means of which this was proved is described in the chapter devoted to Trench Fever, from which we learn the details of proof whereby it has been shown that the excreta of lice who have fed upon subjects already infected with trench fever, when rubbed into the broken skin of a healthy man, are capable of producing the fever in the person thus vaccinated. Such excreta may remain as dry dust in clothes or blankets for weeks or months and may be eventually rubbed into the wounds or scratches of one who has never known a louse. Not only skin abrasions may thus become the portals for this poisonous dust, but even the delicate membrane of the eye may be the portal through which an infection may be introduced.

The soldier who has the trench fever germ in his blood and harbors in his clothing lice, may become the indirect means of producing enough lice excreta to cause an attack of the disease in every man in his battalion, as the infected dust becomes spread abroad by the wind and falls upon his comrades.

We commend this little book to the interested study of every intelligent man.

LEWIS S. PILCHER.

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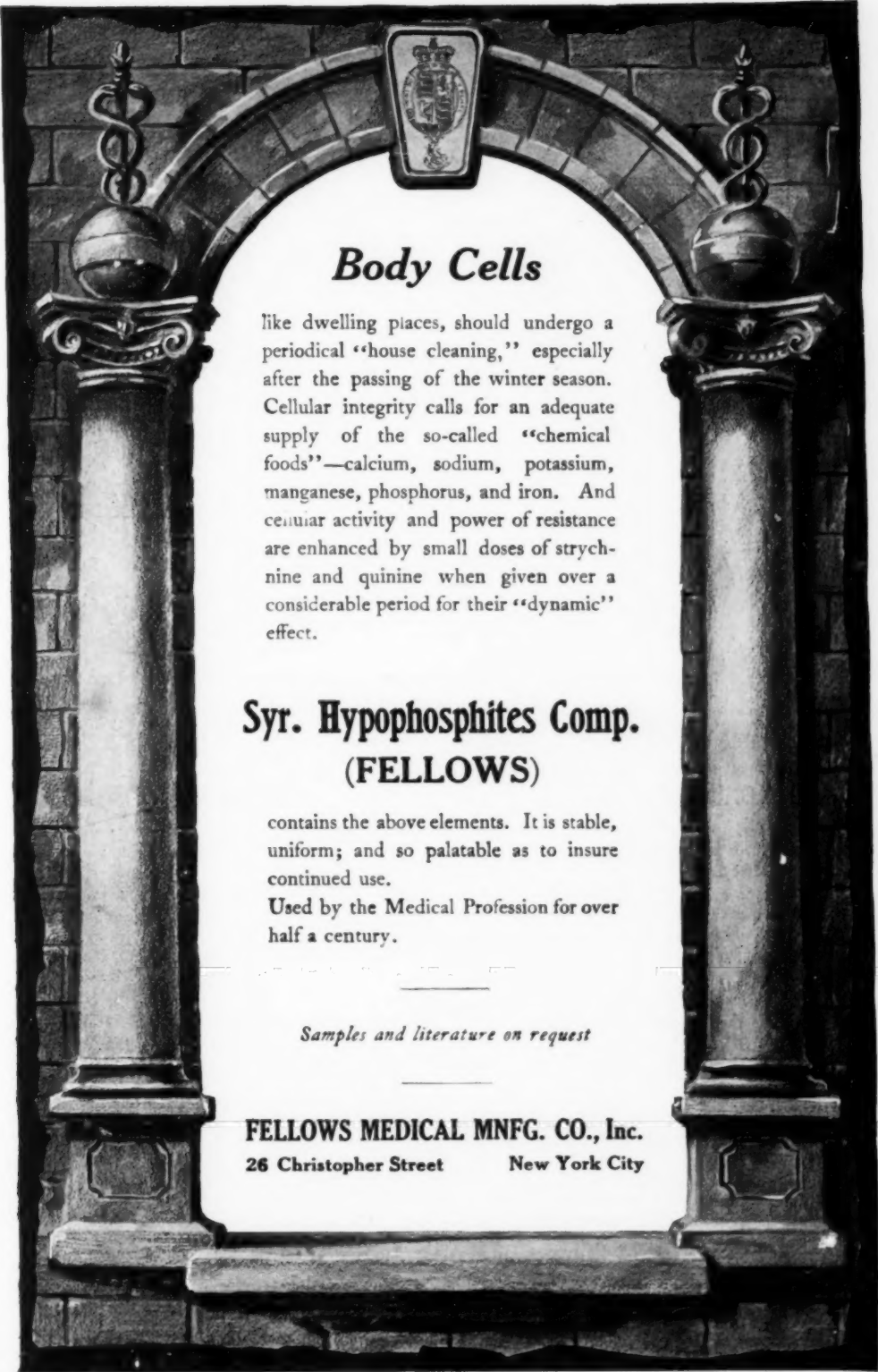


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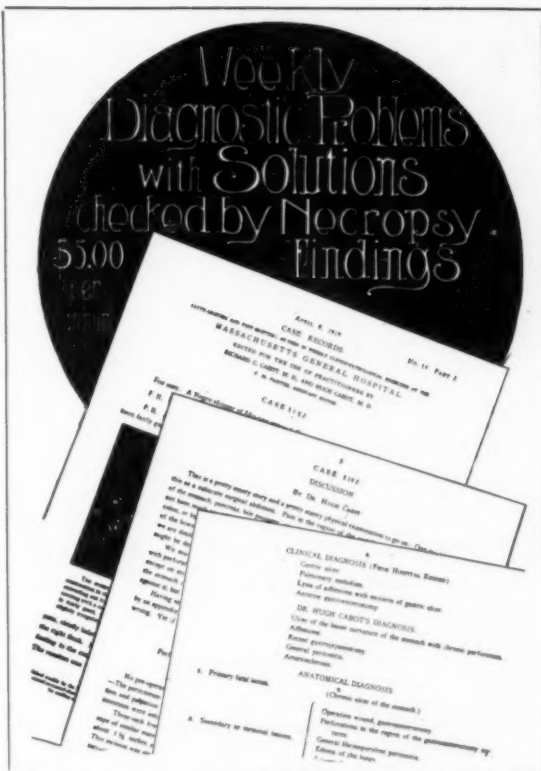
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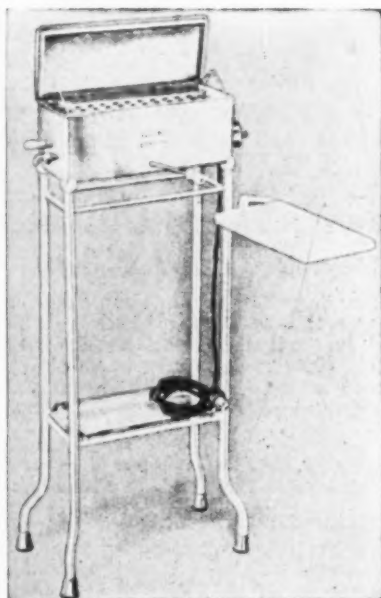
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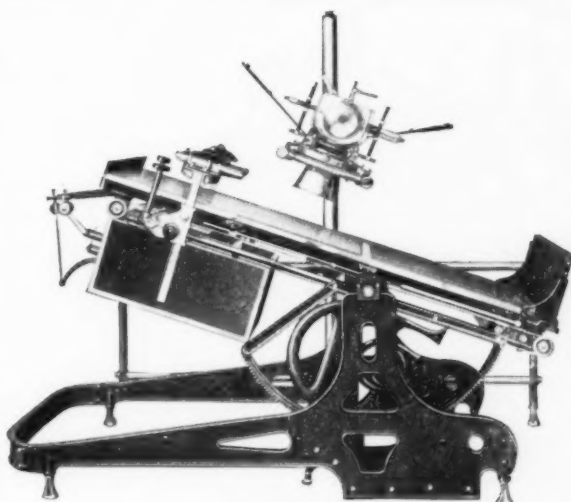
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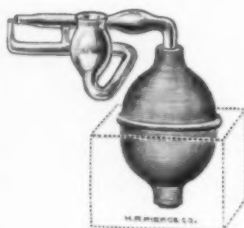
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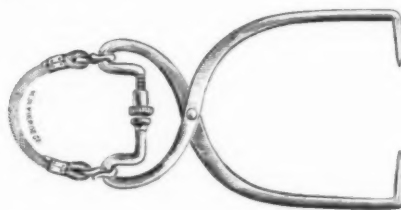
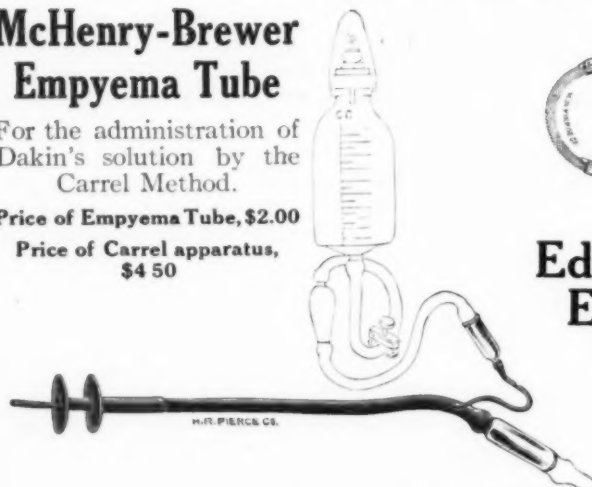
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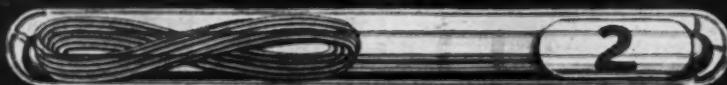
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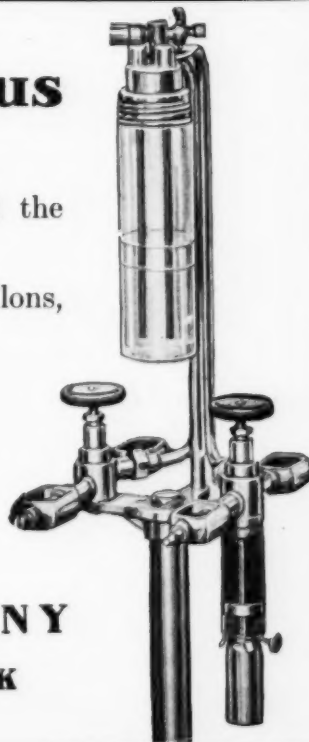
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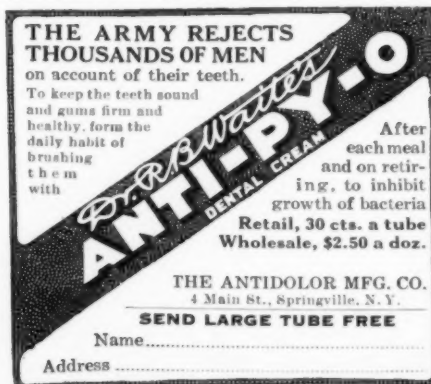
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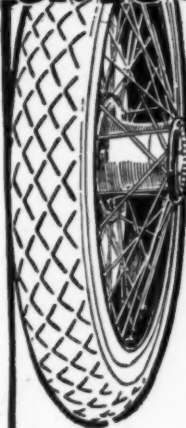
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